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EDITORIAL NOTES.

Federation Preliminaries.

WHEN presiding at the recent annual dinner of the British Commercial Gas Association, it was intimated by the President of the Institution (Mr. Edward Allen, M.Inst.C.E.) that the question was in the air of the federation of the Institution of Gas Engineers, the Society of British Gas Industries, and the British Commercial Gas Association. The movement has already commenced to take the necessary preliminary course. Representatives of the Councils of the three organizations have been in conference; and it has been decided that seven members of the Council of each organization (the representatives of the British Commercial Gas Association not being members of the other two organizations) shall meet and discuss the question of a central organization, and see whether it is possible to evolve a workable scheme. But this step is not in any way to commit or bind any one of the organizations. It is purely preliminary; and the members of the various organizations will be consulted before anything is done. Therefore the power to ratify or to veto any plan to bring about the suggested industrial trinity will rest exclusively with the general body of members of each organization. The Chairman of the Council of the Society of British Gas Industries (Mr. W. D. Helps) referred to the matter in the paper that he read to the members last Thursday; but we rather think the paragraph was written before the conference had taken place to which allusion has been already made. So far as we are acquainted with the ideas that are animating the movers in this matter, what is in view is a federation that will set up a strong industrial council fully representative of the three bodies, with the preservation of the individuality and rights of each organization as a section in the federation. In this way there would be no loss of identity; no loss of platform; no loss of the present effective power. The gain would be a solid front, joint conference, united action, and representative equality. All sections of the industry—professional, manufacturing, financial, and commercial—would share in the work of the Central Council, providing that the British Commercial Gas Association were bound to select only representatives who were not members of either of the other two organizations. There has been much heard as to oneness in the industry, and as to co-operation. The proposal bids fair to give a strong embodiment to it all, and to supply a force that will enhance effective operation in behoof of the industry.

The Gas Acts of Last Session.

IF a curve were made of the volume of Private Bill Committee work during the parliamentary sessions of the past quarter of a century, last session would, we believe, show an unprecedented dip; for a more shallow session in the quantity of contentious work could hardly be imagined. In reviewing the Gas Acts of last session, this condition of things is reflected in what we have found. There has been such a small amount of change in the provisions of the measures from the time they were introduced, that it would have been waste of space to have gone over them in detail, or to have done anything more than we have done—indicate the deviations from the printed originals of the Acts. That there was so little contention, and so little alteration, are sufficient clues to amicable and satisfactory conferences between the promoters and the local authorities concerned. The undertaking of electricity supply by the Tottenham and Edmonton Gas Company (renamed the Tottenham District Light, Heat, and Power Company), the Herne Bay, and the Westgate and Birchington Gas Companies (the two latter have now "and Electricity" incorporated in their titles), is a significant proceeding; and there are signs in the Acts of authorization being granted to negotiate and agree with local authorities for the sale and transfer of their electricity supply concerns. There can be no sound argument in opposition to the economic advantages of this movement. These and the instances of similar happenings that preceded are but the beginnings of what may eventually prove to be a large development in the conjunction of the light, heat, and power supplies of many localities. The calorific value clauses in the Redcar Gas Act are a feature of the notices of the group of measures examined in other columns this week. Illuminating power and calorific value standards running concurrently are very undesirable; but, in this case, the illuminating power standard being only 12 candles, it is not sufficiently imposing to make much ado about it. But gas suppliers ought to set themselves resolutely against the principle of a dual standard. The clauses in the Redcar Act also run entirely counter to the consensus of opinion of experts that the gross value and not the net should be taken as one of the terms of the calorific standard; and it is better that the value should be expressed in British thermal units than in calories. If the advisers of gas undertakings are not prepared to advance a uniform nomenclature in connection with calorific value clauses and conditions, perhaps the parliamentary authorities will keep the matter straight, as they have occasionally done in relation to other modern provisions. They will find the model (apart from figures, which may need alteration according to local circumstances) in the South Suburban Gas Company's clauses of 1912.

Calorific Value on the Parliamentary Road.

THE prediction that Sir Corbet Woodall made from the Presidential Chair of the Institution of Gas Engineers last June, that the substitution of calorific value standards for illuminating power ones would be a feature of the coming session, and would give a swing to the change-over from the useless to the useful standard, is going to be fulfilled, judging from the notices of Bills so far to hand. The Gaslight and Coke Company are seeking relief from thraldom to two standards. The illuminating power one is to go; and the Company will ask for the revision of the terms of the calorific value one, and, in doing so, will adopt the definitions of "gross" value and "B.Th.U." in place of "net" and "calories." We are particularly glad to see this, as, supported almost without exception by the opinion of those expert in calorific testing, we have made a special point of contending for both terms—"gross" and "B.Th.U."—even before the South Suburban Gas Company's Act of 1912 gave a model in this regard. The Gaslight and Coke Company from the first have recognized their responsibility not only to themselves but to the gas industry in this matter of calorific clauses. But circumstances and experience were against them at the outset in getting complete freedom from the illuminating power standard, and in obtaining the conditions required in respect of a calorific value standard. But from the first it was recognized that what was done in 1909 was more or less of only a temporary and tentative character; and that time, with the helpful rather than the obstructive attitude of the London County Council in the matter of gas-supply regulation (as evidenced by what was done in the case of the South Suburban and Wandsworth Companies in the session of 1912), would bring about the needed adjustment. The session of 1914, unless anything now unforeseen happens, will find this done.

Another applicant for the change of standards is the Liverpool Gas Company; and this forward movement of the Company coming in the year of Mr. Edward Allen's presidency of the Institution of Gas Engineers gives us a double event of no little interest and congratulation. The action of the Company will be an influential example in the gas industry. Among Corporations who are asking to have the only sensible standard applied to their gas supply are Middlesbrough, Ossett, and Walsall. The other undertakings that are doing likewise are Edenbridge, Isle of Thanet

(Margate), Leighton Buzzard, Leyland, Lurgan, Riddings, Skegness, Southend, and Wadhurst. This list we believe will be extended by the time the complete notices are before us, and will be found still further lengthened when the Bills are actually at hand, as among the notices are those of various undertakings in which the simple announcement is made that they will be making application for fresh provisions regarding the testing of gas. This shows that we are now well on the high road to the change from the (in practice and value) obsolete standard to the only one worth recognizing to-day; and those gas companies who go to Parliament now, and continue the illuminating power standard, unless there is something (which we cannot see can exist) to justify them in simply marking-time, will show an old-fashioned inclination. From what has been heard from various quarters, we rather think that some local authorities will be trying to force the change in the case of certain companies who are not voluntarily proposing to adopt it. All companies promoting Bills who have not arranged for a calorific power standard, and whose Bills will be contested, had better be prepared for this.

The notices of Bills published to-day (which will be supplemented next week) are indicative of a very interesting session, and one with, for the gas industry, a fair amount of life in it. We will not comment generally on the Bills until the complete list is before us; but it may be pointed out here, that the absorption of small undertakings and the request for electricity supply powers will again be prominent features of the session.

Shareholding and Open Trading.

From over his side of the fence, Mr. W. D. Helps, the Chairman of the Society of British Gas Industries, showed himself last Thursday. The occasion was the autumn meeting of the members, held under the presidency of Professor Harold B. Dixon; and the means adopted by Mr. Helps for a little free expression of thought was a paper, which he had entitled "Thoughts by One Who Thinks." Many of us think a great deal; but all that is evolved by the mind does not—perhaps fortunately—see the light of day. We may take it that, on the points in regard to which the Chairman expresses an opinion, he has thought deeply, and has concluded that what he thinks on the matters treated upon is worth publication. Let us say at once that, though there are in the paper sundry points, phrases, and modes of expression that could be criticized by anyone disposed to be captious, we like the tone of the paper, because it is palpable that it is in all of its parts (if we leave out of the reckoning a few asides in obvious humorous vein) compounded of honest belief. Beyond question to-day is the claim to power and usefulness of the Society; and, through the record of what has been done in connection with it, there run as primary characteristics "oneness of aim, unity of purpose, "and identity of interest." Later on in the paper there is found a definition of "oneness of aim," when the Chairman says that the "sole aim" is the success of the gas industry as a whole, and its maintenance as the premier industry for the supply of light, heat, and power. Moral philosophy had a good part in Mr. Helps's thoughts as he meditated over the subject-matter for his paper; but while the ethics of the business life are preached from the collective platform, we prefer to see them for ourselves in the daily common practice. In the trading of the gas industry, the Society, we do believe, has had, as a result of conference and unity, a remarkably good effect in strengthening, in the right direction, the application of proper, and the uprooting of improper, principles, though we do not agree with the statement as to the narrow object of forming the Society (which statement is contradicted by much else that precedes and succeeds it in the paper) as contained in the words: "The "Society was formed by us as manufacturers to improve "our conduct, in order that we might be the better able "to improve the conduct of others." The conduct of the manufacturers and of the gas industry in 1904 was not in such a deplorable condition that any specially organized missionary enterprise was necessary to effect improvement. That, however, is one of the passages inserted in the paper for effect and notice, in which the Chairman must not be taken too literally.

In association with the oneness-of-aim principle of the Society, there is a point which invites accentuation by yet another remark found in the paper. It is that the manufacturers should encourage "the most gifted men, and those "with the highest faculties, to enter our ranks as traders, "so that the ever-increasing volume of gas plant, with all "its accessories, in growing perfection may be at all times "forthcoming." That is very laudable and proper, because the most perfect plant and appliances make for the economy in both gas manufacture and use which is potent in creating an increasing popularity. But we have to get beyond that. Just as an area of land sets the limits to the possessor's opportunity for cultivating and obtaining produce, so the limits of gas consumption form the boundary lines to the manufacturers' opportunities for business. The first thing to be done therefore is to work mutually for the development of gas consumption; for development, and that alone, gives the manufacturer enlarged opportunity.

It is an extensive co-partnership that exists in the gas industry as between the gas suppliers on the one hand and the manufacturers on the other. The interdependence is there, and is unalterable, no matter how much some would, for selfish or other motives, rather not recognize it. Clearly the paper by Mr. Helps shows that he is not one of them. But, though there is this interdependence, there are not the same opportunities for making profit by those who hold the capital; and from our point of view not much good can come from publicly administered "digs" on the score of profit-making at one side from the other—no matter which. One striking difference in profit-making as between gas undertakings and manufacturers is that the divisible amount of profit is controlled on the one side, and it is unlimited on the other—if it can be made; and, in but few instances, it is made. As representing competitive manufacturing concerns, the Chairman says that the "attainment of the same "profitable results that gas undertakings achieve *without* "*anxiety* is only accomplished [by the manufacturers] by "determined doggedness and untiring effort. We have to "make our modest profits, while the great difficulty of gas "administrations is to dispose of the profits they so easily "make." The "without anxiety" clearly constitutes an overstepping of the line of actuality; while, on the "deter-"mined doggedness and untiring effort," most of the manufacturers look uncommonly well-circumstanced, and their "modest profits" as expressed in terms of dividend in their accounts frequently appear to be of an order that those in the gas-supply industry are debarred from applying by an inexorable regulating Parliament.

We are quite in agreement, however, that, in these so-called "modest profits" of the manufacturers, neither the administrators nor the executive officers of the gas-supply industry should seek to share; and yet, on the other hand, there is not the same objection to the manufacturers of gas plant and appliances investing in gas undertakings their reserves and their unallocated profits. There are a great many temptations, says Mr. Helps, "for us, as two bodies, "to have contra accounts—gas shares and traders' shares. "I do not know which has the advantage; but if not very "carefully and generously viewed, it is possible, through "self-interest, to create a state of affairs even worse than "existed thirty years ago." A little later on we get the explanation as to what was running through the Chairman's mind at the time he penned the foregoing, when he suggests that gas engineers, managers, and secretaries should "divert "their investments to remunerative lines other than those "which must of necessity create food for scandal, although "not always from the fact that, through their direct interests, "it means their orders, irrespective of justice, being sent "to those companies in which they are interested—far from "it. I could enumerate many instances where it prevents "orders going where, on merit, they should go." The under-talk in the gas industry of this sort of thing—of shareholding and patronage going together—however true, is not very pleasant; and the truer it is, the more unpleasant is it. We know that many trips are made to Somerset House by the agents or representatives of disappointed contractors so as to ascertain whether there are names on the shareholding lists of the "successful" trading companies that can account under certain circumstances for the preference in contract-placing that has been shown.

We have been asked on various occasions to enter into this matter, and to strongly expose a system which indicates, if it does not confirm, that shareholding and patronage frequently go together. But it is not our business to judge any man's actions in this way. We could not pick from a list of shareholders in a trading company the name of a gas official, and say that the fact of his holding shares in it is the sole reason for his patronage of that trading concern. The fact of his holding

shares at all events is *primâ facie* evidence of confidence in the concern; and he might truly urge that there is no valid reason why, from all moral standpoints, he should be deprived of an investment that is at once very lucrative, and in which he believes. All the same, we agree with the Chairman that, in the interests of fair and free trading, trading on merit, and trading over which suspicion cannot hang, there should be no shareholding conjunction between an executive official and a concern with which the undertaking he serves does business. If shares were held by an officer of a gas undertaking in a trading concern, and business was not done with that concern by the gas undertaking, well and good. But the trading concerns would be the first to wish those shareholders farther, if the managements knew that they were a bar to business. To put it shortly, we cannot get away from the fact that there is the suspicion of shareholding being, and naturally, a creator of favour without regard always being had to merit, and to other things.

In the case of the manufacturers investing their reserve and surplus funds in gas undertakings, the position is different. The manufacturer has nothing to buy from the gas undertaking unless his works are in the area of gas supply, though he may hope that his shareholding will create favour on his behalf in the placing of orders. But there is no certainty that it will do so; and he cannot complain if it does not. The shareholding will not persuade a conscientious executive officer to by-pass the tenders of other firms, if in point of merit of goods, or of cheaper rate, he can do better with them. Putting the investments side by side, the same objection cannot be discovered to manufacturers of gas plant and appliances investing in gas undertakings (it is a natural investment for them to make) as there can be to executive officers of gas undertakings investing in trading concerns with which their undertakings do, or may possibly do, business. To say the least, the latter is a somewhat impolitic investment.

Touching closely this matter is another. There has been a fair amount of talk, open and covert, regarding gas engineers in official position deriving profit from their inventions. We are not prepared to countenance any view that they should be ruthlessly cut off from a continuous profit from trading in something that is the product of their own brains and exertion; and, indeed, such a proceeding would be the best possible way of stemming the exercise of individual talent in invention. There is a positive and complete difference between such engineers and those who use their position to profit themselves by influencing trade in anything pertaining to matters coming within their professional work, and of which they were not the inventors. We cannot think that Mr. Helps was in anything more than humorous mood when he suggested that gas officials with a good notion, useful to the gas industry at large, should give it, or sell it, to those who make and trade. The altruistic trait in humanity has not developed to such a degree that in all cases such a suggestion would be entertained; and we have not yet met with any trader who practises in any relative manner what Mr. Helps suggests. Ability and the exercise of brains must be paid for; and the gas engineer who invents something good has a right to trade in it, and to obtain a due reward. If called upon in an advisory capacity (where his advisory position and his invention would make contact) then there is a danger; but an engineer of parts will know how to act, so as to preserve a reputation for independence.

In these various matters, Mr. Helps recognized that he was treading on delicate ground; but we all admire a man who has the courage of his convictions, and expresses them —more especially when those who hear, and those who read, are conscious that the views are in the main right, even though unprepared to give them any deliberate public endorsement.

Mechanical Economies.

The development of the operations of gas-works and the application of new practices in themselves produce fresh requirements; and the fortunate thing is that what is needed is generally found to be at hand, and, if not, then ingenuity comes to aid, and provides what is necessary. Furthermore, the operations of a gas-works from what we now regard as a fairly moderate size to the largest are of such varied nature that some of the new invention in other fields of industry is frequently found applicable with economical result. Illustration of these points is found in the paper which Mr. Harold W. Woodall read at the meeting of the Southern District Association on Thursday last. It was one of those papers that covered just sufficient ground to elicit useful experiences under different circumstances. Mr. Woodall admitted that he had nothing new, except his own experience, to impart to the members. But it must never be overlooked in these matters that what may not be new to some engineers may be new to the majority, who are naturally interested in hearing of those things that other engineers have found to contribute to the economy of their undertakings. We know that it is the few rather than the many who have had experience of oxide disintegrators and of pan-breeze washers, as well as the use of mechanically propelled vehicles for carrying materials about their districts. These are, however, all things that, at their present stage of development, produce economy for works of a size that numerically are in a minority; but there is always an active tendency in these matters to endeavour to lower, by improvement or change in design, the line at which there can be profit in application. The manager of a works that has an output much below that of Bournemouth need not despair as to a day arriving when (say) an oxide disintegrator will be economically available to him; the same (though perhaps this is something more remote) with a pan-breeze washer; and yet again the same with one or more mechanically propelled vehicles.

The need to produce economy by the aid of an oxide-breaker has followed the production of higher efficiency working in the purifiers—mainly through the employment of the rotation system of operation. Through the caking of oxide, there is difficulty first in removing the material, and, secondly, in breaking it up so as to obtain thorough revivification, and properly prepare the material for use again. With the simple form of breaker that has been adopted at Bournemouth (and elsewhere), a beautifully graded oxide can be made ready to be returned to the boxes again in twenty-four hours. This is a condition of things that, under the old order of manual labour, and with shovel or plough, could never have been effected; the reason of the expeditious work being that every particle of the oxide is, through the mechanical operation, well aërated, and so is subjected to a degree of oxidation that could never be realized under the old order of things. The capital cost of the breaker, foundations, and accessories at Bournemouth was £117. The working costs per ton of material amount to 1s. 3d., compared with 4s. 1½d. under the old method; so that the working saving is 2s. 10½d. per ton. There has also been adopted a simple home-made process of mixing the oxide, which has (including all charges) reduced the cost for this particular work from 2s. 11d. to 6d. per ton; giving a further saving of 2s. 5d. per ton. There is no mention as to the quantity of material dealt with; but an approximate calculation can be made by any engineer desiring to do so by taking the figures as to the Bournemouth gas output. Another figure missing is as to cost of repairs and depreciation; but, with a material such as oxide, the wear and tear cannot be great. It is not, therefore, difficult to see that, under the circumstances of Bournemouth, the saving effected per ton gives a respectable amount from which to meet both interest and depreciation. In considering figures such as those with which Mr. Woodall supplies us, it is frequently observed that there is a too rigid regard paid to the direct savings without taking into account the economies of improved working. In the case of the oxide dealt with by disintegrators as described, there is the prompt manner in which the material is again ready for use, and there is also its improved condition for doing its work. Anyone who has examined, comparatively, the material prepared by the old process and the new will see the difference at a glance, even without the aid of chemical investigation. There is value in this improvement; and Mr. Woodall might perhaps have made more of the point, and extended the information as to his experiences in the matter of the efficiency of the material.

This question of an economy beyond the mere immediate cost of treatment is also found in the mechanical washing of pan-breeze, which process has superseded the hand work to which men do not take kindly. In this case the cost of mechanical operation is 1s. 6d. per ton, as against from 2s. 6d. to 4s. 8d. under the old system. But here, again, 1000 tons of coke is recovered per annum as against the 640 tons formerly obtained by hand work from the same quantity of pan-breeze. The 360 tons extra have a value to add to the difference in working costs; and though in this case wear and tear may be, from the nature of the operations, higher than in the case of the oxide-breaker, one can

readily see that interest on the £510 capital expenditure for the plant (which is £50 more than it would have been but for a change that was made in construction) and depreciation are well satisfied from the economies effected.

The third part of the paper treated of the important subject of the transmission of goods about the district of supply. The horse, in proportion to the district work now done, is fast losing place; and, in conformity with the times, motor haulage is the superseding means. But here we have work in regard to which the factors that go to make up costs vary so considerably that nothing reliably comparable can be obtained. The costs of running, depreciation, and repair depend upon thelevels of the roads, the loads carried, the distances covered, the density or openness of the traffic, and the degree of use of the vehicles. On the character of the district depends too (in relation, of course, to weight), the horse power of the motor required; and this, in turn, affects capital expenses. One thing that is clear from the paper and discussion on it is that steam haulage is cheaper than petrol or benzol driven vans. But the figures quoted by Mr. Woodall (limited to labour, fuel, and stores) can hardly serve as a fair guide as to what can be done by a petrol-driven motor, seeing that the vehicles he employs are not of the most modern order. As a matter of fact, against the 6·11d. and 6·3d. per ton-mile mentioned in the paper, Mr. T. Goulden finds that, in the area of the Gaslight and Coke Company, transport work is done for about 4d. per ton-mile. But there again, the road and traffic conditions of the districts are not comparable. Bournemouth has its hills; the Gaslight Company's area has level roads, but dense traffic. Then Mr. Doig Gibb has found that, with different vehicles and different conditions of work, the costs in South London (using benzol) vary from about 3½d. to 6½d. per ton-mile; he also finds that whether running light or running heavy does not make a considerable difference. But his testimony is valuable in that it shows that, including the wiping-out of first cost by seven years' depreciation, the expense of motor work is lower than horse traction, with the valuable advantage of greater expedition. The testimony of Mr. A. E. Broadberry, Mr. Thomas Glover, and Mr. H. O. Carr all goes to show that steam traction is the cheaper, in this regard confirming Mr. Woodall—Mr. Carr's information being especially useful. There is another advantage in steam traction, in that it makes use of a gas-works bye-product; but the old order of steam-propelled van is a perfect nuisance when used in a residential district. The petrol van, on the other hand, can go anywhere without raising any very serious objections. However, if a lighter steam-driven van with tyred wheels comes along that can be used anywhere, we are confident that it will, for several reasons, obtain large popularity among gas undertakings, for conveyance of goods about their district has become a very important thing, and will be more so with the development of the home trade in coke. This and other matters dealt with in Mr. Woodall's paper are ones on which the narration of experiences under other circumstances would be serviceable.

Tar Extraction from Water Gas.

The study which Mr. R. P. Harris, of the Commercial Gas Company, has been making of the question of the removal of tar from water gas, and the results of which he embodied in a paper read before the Southern Association last Thursday, taken together with the discussion, shows there is here a subject that is worthy of still greater investigation. Mr. Harris has carried his inquiry as far as the plant at his disposal and the surrounding conditions enable him to do. But the variety of experiences evoked by the reading of the paper, using different kinds of plant and under different practices—in some cases, practically no tar-fouling of the purifying material, with the gas found tar-freed on testing—suggests that here we have a subject for investigation almost as elusive in the matter of the causes of the differences as was the "Naphthalene Question" at one time of day.

But two or three facts are clearly established by the paper, and in a measure are supported by the discussion. In the first place, frictional methods of gas cleansing from tar are not much good; and, in the second place, their degree of efficiency depends largely upon the velocity of the gas, or upon the momentum given to the minute tarry vesicles or particles before making contact. But a 70 or 80 per cent. efficiency is not good enough, if one wishes to ensure, even after filtration through sawdust or breeze, freedom from trouble with one's purifying material. When one considers the nature of tar fog, the point made as to the effect of velocity is readily understood; and it puts us on the road to appreciating the beneficial effects that must accrue from treatment in a rotary machine such as the one variously equipped with blades or "beaters," with which Mr. Harris has been experimenting, or from the centrifugal action of one of Dr. Colman's "Cyclone" tar removers, which have been successfully applied in quite a number of works. If we look at the last table in Mr. Harris's paper, and examine the results obtained from his experiments with his rotary apparatus, it will be seen that the type of blade, mesh, and revolutions all appear to have part in the promotion of efficiency—No. 2 test showing the greatest efficiency in the amount of tar extracted, although at the low temperature of 60°. The question of the effect of temperature would bear further study. Good results are also obtained at some works by the use of a Livesey washer. It would be of interest if Mr. Chambers would expand the information he gave at the meeting as to the excellent experience at Harrow, using a washer of the type named, and low condensation temperatures.

The paper ought to result in the prosecution of further inquiry. From the discussion it appears that the suppression of trouble in this direction can be effected by available means; and Mr. Harris seems to have within his reach an alternative method. But we want to know which is best in efficiency and cost—the positive information at hand being of a rather scanty order.

A House of Light

A letter from Mr. Charles Carpenter, D.Sc., on the subject of an exhibit at the Anglo-American Gas Exhibition next year appears in our "Correspondence" columns; and it puts clearly before our readers his views in regard to the matter. It seems that there is no chance of the scheme being taken up as an industrial affair, in view of the National Gas Exhibition having been so recently held. But Mr. Carpenter is not prepared to take this as final, or as completely shelving the scheme. He therefore makes a definite proposal. It is briefly that one of the buildings near the Court of Honour at the White City should be taken—not for a general gas exhibit, but to make a special display of modern gas lighting, to prove to the general public who will pay for admission to the White City, and who will go there in the ordinary course for recreation and sight-seeing, the virtues and general decorativeness of gas lighting.

And a Responsibility.

Mr. Carpenter's experience is that, in the matter of domestic heating of all kinds and industrial use, gas has no real competitor as a labour-saving agent and for all-round efficiency; and business in these lines will continue to develop. Lighting is the part of the gas business—and it is still the backbone of the industry's business—in which competition is most rife; and, as we have before pointed out, much of the loss of custom in lighting has been due to the public being ignorant of the refinements of the modern applications of gas as an illuminant. There is no doubt whatever about it being a responsibility that rests upon the gas industry to stem misapprehension and ignorance in this respect by taking advantage of every opportunity for proving the contrary by demonstration, and for informing the public upon the important question of the quality of gas-light. Mr. Carpenter does not expect to obtain general support for his proposal; but he does hope that there will be a number of gas administrators sufficiently spirited and enterprising to make it possible to have a House of Gas-Light at the Centenary Celebration of Peace and Progress of the two great English-speaking nations next year. In his letter, he makes a generous offer in the name of the South Metropolitan Gas Company, who did such eminent service for the gas industry at the Ideal Home Exhibition. We may refer readers to our "Correspondence" columns for Mr. Carpenter's actual proposals.

Melbourne Wages Award.

The award that has recently been made in the matter of the wages of the gas-workers of the Melbourne, Brighton, and Hobart gas companies, is of interest apart from the actual minimum rates of wages that have been fixed. Adjudication of the matter was in the hands of Mr. Justice Higgins, sitting in the Commonwealth

Arbitration Court. Arbitration over wages is being carried almost to a fine art; and in any determination that is now made, it is not merely a question of the amount and character of the work performed, and market prices of labour in the locality, but factors of an altogether different order are introduced—the current cost of living, and whether the work in question requires special skill, or special physical powers of endurance, or otherwise. Consideration of such questions as these may bring about a larger measure of justice in the matter of recompense for labour, but it certainly adds to the difficulties of adjudicating on such a delicate matter as what is a fair minimum wage. However, Mr. Justice Higgins showed great discrimination, and took an enlightened view of these contributory controlling points; and he has produced an award which (taking into consideration the differences in circumstances beeween Australia and this country) appears to us, judging from the distance, to be about fair. The matter as it affects the Melbourne Company, and their yardmen and the stokers, is sufficient for reference here.

The Lines of the Decision.

The difficulty and complication for the Judge was not lessened by the fact that the Sydney gas yardmen had secured an advance to 9s. per day and the stokers to 11s. But this fact has been the means of establishing that, the cost of living being higher in Sydney than in Melbourne, a difference on that ground must exist between the gas workers' wages in the two cities, just as differences in this regard obtain in this country. The difference has been assessed at, to give a round figure, 6d. per day on the wages; and as the cost of living in Melbourne has increased since the last rise in wages was made, the arbitrator has fixed on 6d. as being a proper addition to the 8s. formerly received by the Melbourne yardmen, and 3d. as being the correct amount to add to the 10s. 3d. formerly paid per shift to stokers. This shows how near the Melbourne Company had already arrived to what the Judge considered fair wages for their employees. Although the men are receiving 6d. less than their fellows in Sydney, they are really in a more favourable position; seeing that the purchasing power of their money is somewhat greater. Then another point upon which pronouncement has been made by Mr. Justice Higgins is that the recognized difference in Australia of 2s. per day or per shift between the wages of a yardman and a stoker appears to be fair; but he declines to recognize—and properly, we contend—that a stoker is a skilled person the same as an artizan. On the other hand, for such work the stoker has to have the necessary physical qualifications; and special bodily requirements for arduous work must be paid for. There is commonsense in this; but it brings us to the point as to whether, and if so how, the worthy Judge would make a distinction in this respect between the stoker with shovel and rake, the machine attendant for horizontal retorts, and the vertical retort worker. The degrees of physical endurance required are all different in these cases. The Judge, as already said, had a difficult task; and he must have been assisted materially by the manner in which the case was placed before him, particularly by the Melbourne Gas Company's present Engineer, Mr. Philip C. Holmes Hunt. The Company are also to be congratulated on the fact that the injustice has not been done them of having the wages levelled-up to those prevailing in Sydney; but there was a prospect of this being done had not the evidence that Mr. Hunt was able to furnish been of such an incontrovertible nature.

Coke in the London Market.

"Everyone for himself" seems to be the attitude of some gas managers at the moment in regard to coke, with their yards overflowing with stock; but what is being done will have the effect of spoiling the general market for coke throughout the country. Certain gas undertakings outside London, obtaining as much as they can locally for coke, are supplying the dealers and retailers of coke in London at prices that are killing the market for the London Companies; and this must eventually react on the Provinces. Here we have dealers and retailers advertising freely among householders in London and the suburbs coke at 15s. per ton; and in one advestisement the figure is named of 11s. 6d. per ten "sacks." While this is being done, the London Companies are trying to maintain a price of 1s. 1d. per cwt. for household purposes. The position for them is an unfair one; and it is a position that must, if it continues, produce a state of affairs that will have an uncomfortable ending in regard to this market throughout the country. The President of the Institution (Mr. Edward Allen, M.Inst.C.E.) referred to the subject at the Southern District Association meeting last Thursday, and mentioned that he has called a conference in regard to it for next Monday, at the Institution offices. The London Companies do not wish to put a ring-fence round the London market; but they do want to be able to obtain fair prices for their huge coke production. The maintenance of prices in London must be beneficial to the entire industry; but dumping coke into the Metropolis at prices that enable dealers to sell at shillings below the London Companies will be anything but advantageous to the industry generally.

Coke and Carburetted Water Gas.

Another thing that Mr. Allen urged is that gas undertakings should make as much use as possible of their carburetted water-gas plants. Of course, advice of this kind under the present circumstances of the oil market will be taken in varied spirit. Evidently the President's idea is that, in view of the state of the coke market, it would be better to bear a present extra expense in water-gas production compared with coal-gas manufacture than swell the coke supply more than is inevitable. When coke was commanding higher prices, and oil was also at a high figure, the conditions were somewhat different from those ruling now, when gas undertakings can supply fuel to the water-gas generators on liberal terms, and know that for every ton of coke used therein, relief is being given to the coke heap to the extent of say 3½ to 4 tons. Still the cost of the gas into the holder is dear; but it is also a matter for consideration as to what is most politic under the circumstances. Mr. Allen is looking hopefully for oil to receed to 3½d. We hope sincerely his view, and beyond it, will come true. At the moment, we fail to see the sign on the horizon.

The London Coke Committee.

While London is being treated to such undesirable attentions from gas undertakings who are parting with coke at prices that must do much to crush the efforts to get fair prices in relation to other solid fuel, the London Coke Committee have set seriously to work to attempt to increase the coke absorptive power of the Metropolis and the suburbs, by promoting its use for all fuel purposes. The Committee, by the way, has been formed by the Gaslight and Coke Company, the South Metropolitan Gas Company, the Commercial Gas Company, the Brentford Gas Company, the South Suburban Gas Company, the Wandsworth, Wimbledon, and Epsom Gas Company, the Tottenham and Edmonton Gas Company, the Croydon Gas Company, and the Ilford Gas Company. The Committee are therefore working under powerful auspices. The Engineer and Fuel Expert is Mr. E. W. L. Nicol; and the Secretary is Mr. E. E. Rudge. The offices are at No. 39, Victoria Street, S.W. The first three of the Committee's leaflets for circularizing householders and manufacturers, or enclosing in letters, are attractive productions; and they have been prepared so that they will fit the requirements of any gas undertaking—in fact, two of the circulars have been so arranged that the name of any gas undertaking can be printed on them. The prices of these circulars are quite reasonable; and they can be obtained on application to the Secretary. In connection with local coke publicity work, we see the Croydon Gas Company have a striking advertisement in their leading local paper; and a special article, headed "Smoke and Economy," and dealing with the advantages of using coke, appears in the same issue.

Employers' Defence.

Reference has already been made in our pages to the formation of the United Kingdom Employers' Defence Union, as the result of a meeting held under the chairmanship of Lord Dysart; and now the matter has been carried a step further by the issue of the prospectus. The central idea, of course, is the creation of a guarantee fund of £50,000,000; and, subject to certain conditions, two manufacturers have already guaranteed £50,000 each. Calls in any one year are not to exceed 7½ per cent. on the amount guaranteed; and it is believed that much less than this will suffice to secure the objects aimed at. These, briefly, are the defence of the right of members to carry on their business free from outside interference; to maintain the inviolability of contracts; to prevent intimidation and assaults by trade unions or others; and to promote the peaceable and equitable settlement

of differences between employers and their workpeople. It is not intended to oppose collective bargaining, conciliation boards, or any trade unions which conduct their business in a moderate and reasonable manner, and which keep the agreements they make and insist upon their members doing so. Lord Avebury is Hon. Treasurer; and Mr. Mark H. Judge, of No. 7, Pall Mall, S.W., is Hon. Secretary *pro tem.* These objects are no more than employers should strive for both for their own sakes and for the sake of the industrial world at large. And if a fund of the dimensions stated should be considered by some people in the light of a threat held over the heads of the men—though this is not the intention—it is, even so regarded, of a milder form than might be justified. A statistician has been working out some figures based on the particulars given in the Board of Trade report on strikes and lock-outs lately noticed in these pages. He calculates that the cash value of time lost through labour disputes in 1912 was over £8,000,000; and as the value of wage increases due to labour disputes was £2,000,000, there was a net cash loss to the workers of about £6,000,00. It would seem, therefore, that in the long run strikes must prove too expensive to the workers to be indulged in; but this conclusion has not been arrived at by them yet, and meanwhile a state of affairs exists which urgently calls for remedial measures.

Illumination in the Provinces.

Reports were presented, at the meeting of the Illuminating Engineering Society on Tuesday last, as to the developments that are being made to advance the interests of scientific illumination One of the most interesting statements was that the Council have seriously under consideration a suggestion put forward by Mr. R. G. Shadbolt, at one of the conferences at the National Gas Exhibition, as to the formation of local branches in the Provinces for the study of illumination. But it is questionable whether any one locality other than London would be strong enough just at present to sustain a section of its own. A better idea for the inauguration of work in the Provinces seems to be that an attempt should be made to hold conferences in the large centres under the auspices of the local authorities, so as to give an impetus to the study of, and through the local Press greater diffusion to, the laws of proper illumination. From what Mr. F. W. Goodenough and Mr. Leon Gaster said, this seems to be the idea that the Council are inclined to prosecute. Meanwhile, it is understood that reports of the conferences at the National Gas Exhibition are going to receive a wide circulation among those concerned in our educational institutions, and among the manufacturers of the country. This will be an excellent method of giving the fruits of the conferences a well-directed publicity.

Shadows and Artificial Illumination.

Shadows are not generally regarded with a favourable eye; but the new school of artificial illuminationists tells us that, when not too dense, and with edges nicely shaded off, shadows are not at all bad things in their proper place, as they assist in imparting effect, and are beneficial in preventing monotony. Messrs. Dow and Mackinney have been making a study of shadows thrown by different means of illumination; and they communicated the results of their studies to the members of the Illuminating Engineering Society on Tuesday last. In interior lighting, and for indoor work, more especially in factories, one does not want sharp, dense shadows; and they are the product of direct lighting. The photographs that the investigators showed of different systems of lighting, under the same conditions, indicated clearly that, with indirect, or preferably semi-indirect lighting, the shadows are toned-down, and are not so well defined, as with direct lighting; the reason being that, with the newer systems of illumination, the light is better diffused than from a direct source. So much is this the case that, under furniture and machinery the base of which is raised from the ground, the light penetrates underneath in a manner that is not obtainable with direct lighting. There is value in such studies as these. They were carried further to ascertain, by the camera, how modern lighting can be applied to realizing new effects in connection with the bringing into relief of architectural features. In this relation, there is no need to try to obtain by artificial lighting the same effects as are produced in interiors by the oblique rays of daylight. There is no reason why artificial illumination should not be brought to bear to realize a reversal of effect from daylight, if it brings out in better degree the decorative effects. But there is a warning; and it is that indirect or semi-indirect systems of lighting are not the most useful for all purposes. There are some occupations in which direct oblique light rays are required to produce revelations of defects, if they exist, which a well-diffused light will not do. There are some who ridicule lines of illumination study such as these. But our own view is that a broadening of knowledge of illumination is required; and studies of this kind set thoughts running into new channels. When this happens, something advantageous is sure to succeed.

Some Debt Comparisons.

An informative table which always finds a place in the Annual Local Taxation Returns is that comparing the amount of the National Debt of the United Kingdom with the amount of the outstanding loans of local authorities in England and Wales at the end of a number of years, and showing the percentage of the first-named amount to which the last-mentioned sum was equivalent. The earliest year referred to is 1884-5; and then the National Debt was £740,000,000, and the amount of the outstanding loans £173,000,000, or 23 per cent. Since that time, the National Debt has fluctuated a good deal; but at the end of the 1910-11 period it was actually somewhat less, at £733,000,000. There has, however, been no similar fluctuation in the amount of outstanding loans. The tendency has all along been in one direction—upwards. By 1904-5, the total had reached 58 per cent. of the National Debt; and in 1910-11, with a figure of over £540,000,000, the outstanding loans had reached 73½ per cent. of the National Debt. In other words, during the period between 1884-5 and 1910-11 the total of the National Debt had decreased by about £7,000,000, while that of the outstanding loans of the local authorities had increased by £367,000,000. That a very large proportion of the expenditure represented in this huge total has been forced upon the local authorities by changed conditions, as well as by normal progress, is well known; but however it may have arisen, it is gratifying to notice that the increase has lately been at a much less rapid rate than was the case some years ago. It is worthy of note that the amount of interest paid during the year 1910-11 in respect of loans was equivalent to about 3·3 per cent. on the total amount of loans outstanding at the commencement of the year; while the provision made for repayment of principal was equal to about a one-thirty-seventh part of the total loans.

MR. FREDERICK BUDGEN, J.P.

An Explanation and an Apology.

We regret exceedingly that, by an unfortunate inadvertence, a paragraph appeared in the "Journal" last Tuesday stating that the Reigate Gas Company had lost their Chairman, by the death of Mr. Frederick Budgen, J.P. We have already offered our sincere apologies to Mr. Budgen for the statement (for which, we were gratified to learn, there was no foundation), which must have caused him considerable pain and unpleasantness. We trust Mr. Budgen may be spared for many years to direct the affairs of the Company of which he is the head, as well as to co-operate with the members of the Boards of the other Companies with which he is associated.

At the first meeting of the Royal Society of Arts for the present session, held last Wednesday, Mr. Frank Bailey, M.Inst.C.E., was presented with one of the Society's silver medals for his paper read last session on "Electric Supply in London."

In a report on the utilization of the lignite deposits of the province of Saskatchewan, Canada, Mr. R. O. Wynne-Roberts, M.Inst.C.E., states that the large quantities of workable lignite deposits in the province can be utilized at the coal centres for the production of power and its distribution in adjacent parts.

We have received a copy of the annual report which was presented to the recent meeting in Leipzig of the district representatives of the Berufsgenossenschaft der Gas- und Wasserwerke. It shows that 178 works joined in 1912, and 23 retired from the list—a net gain of 155. At the end of the year 75,489 persons were insured under the scheme—an increase of nearly 4 per cent. over the previous year.

PERSONAL.

Mr. A. J. JACKSON, the Gas and Water Manager to the Birstall (Yorkshire) District Council, has retired; and Mr. RUFUS ELLIS, the Assistant-Manager, has been put in charge *pro tem.*

The Beal Medal of the American Gas Institute was awarded at the last annual meeting to Mr. CHARLES O. BOND, of Philadelphia (Penn.), for the best paper presented at the meeting last year. It was on "The Photometry of Incandescent Gas-Lamps," and was noticed in the "JOURNAL" for the 21st of January last (p. 190). Mr. Bond is the President of the American Illuminating Engineering Society.

It is with sincere regret that we hear of the retirement, through ill-health, of Mr. GEORGE THORNTON ANDREWS from the position of Engineer, Manager, and Secretary of the Swansea Gas Company. In June last, he underwent a severe operation; and no doubt returned to business too soon afterwards, with the result that he has not yet properly recovered his general health. Mr. Andrews has had 33 years' service with the Company, with which his father also was connected for over 50 years. This is a fine record for one family; and it is pleasing to think that Mr. Andrews' connection with the undertaking is not yet at an end—for, in addition to receiving a retiring allowance, he has had the gratification of being elected a Director of the Company.

The Directors of the Jersey Gas Company have selected Mr. GEORGE F. TWIGG, at present Chief Chemist to the Derby Gas Company, to succeed Mr. R. A. Helps as Assistant to the Engineer (Mr. Harry Morris). Mr. Twigg (who received part of his education at the Derby Technical College) spent three years in the Electrical Department of the Midland Railway Company, and has been for eleven years with the Gas Company, under Mr. J. Ferguson Bell. He has secured a first-class honours and full technological certificate in "Gas Manufacture," honours in "Chemistry," and other certificates in mechanical and electrical engineering subjects. The members of the Midland Junior Gas Association will regret his removal from the district, while congratulating him on the cause.

Mr. J. T. JOLLIFFE is looking forward to the enjoyment of some well-earned leisure next year; for he is to retire from the service of the Ipswich Gas Company at the end of March. This, however, does not, we are sure, mean that his many old friends will cease to have opportunities for occasional meetings with him. The Directors have decided to grant Mr. Jolliffe a liberal retiring allowance, and, in addition to this, they have shown their appreciation of his ability and desire to serve the Company by offering him a seat on the Board. The chief offices in the undertaking will, we learn, be divided up. Mr. FRANK PRENTICE will in future be the Chief Engineer and Manager, Mr. G. MALLETT (the present Accountant) will become Secretary, and Mr. C. C. WRIGHT (who has hitherto filled the office of second assistant) becomes Assistant-Engineer.

In the paragraph which appeared last week giving the names of the new Mayors associated with the gas industry, it was mentioned that Mr. EDWARD ALLEN BROTHERTON is the new Lord Mayor of Leeds. He is head of the well-known ammonia and tar distilling firm of Brotherton and Company, Limited, whose head office is in Leeds, and who have ammonia-works in Birmingham, Glasgow, Leeds, and Wakefield, acid-works in Birmingham and Workington, tar-works in Glasgow, Leeds, Liverpool, Sunderland, and Workington, and depôts at Birkenhead, Grimsby, and Stockport. Mr. Brotherton represented Wakefield in Parliament from 1902 till 1910, and previously served on the Wakefield City Council. He was appointed an Alderman in 1901, and became Mayor the following year. He has recently instituted share and pension schemes for the benefit of the Company's employees.

OBITUARY.

The interment took place at Stanley, Yorkshire, last week, of the remains of Mr. FIELDER DUFFIN, who was Manager of the local gas-works, and was well known in the district. A large company of friends attended.

The death occurred last Wednesday of Mr. JAMES DAWES, who was for eighteen years the Engineer and Manager of the Dorking Water Company. He retired from his position, owing to ill-health, about five months ago.

A Ventilating Gas-Lamp at the Royal Society of Arts.—During the meeting of the Illuminating Engineering Society last Tuesday, the lighting of the historic hall was solely by a multiple-burner inverted ventilating gas-lamp suspended where the old sun-burner used to be. The electric lamps (about the glare of which there have been several references at meetings of the Society) were not in use; but they were not required. The single ventilating gas-lamp gave a soft, well-diffused light all over the place. Several times during the evening, the light had to be turned down owing to the projection of pictures upon the lantern screen. The valve by which the extinction and the relighting of the burner are performed is close by the hand of the lantern operator. The lamp responded well to all requirements.

SULPHUR IN GAS.

The Criticism of the Views of the "Lancet."

WE reprint below from the "Lancet" of the 22nd inst. a letter dated the 12th inst. from Mr. Chas. Carpenter, D.Sc., referring to the article on "The Bane of Sulphur in Gas Supply" which appeared in the "Lancet" of the 1st inst., and on which we commented adversely in last week's "JOURNAL" (p. 570) under the heading "The Bane of 'Lancet'-ese."

The "Lancet" does not attempt to rebut our criticism of the statements in its article, which were seized on greedily by an electrical contemporary as authoritative justification for the conclusion that "coal gas without the intervention of electricity is no more fitted for direct distribution to the householder than grass is proper for infants without the intervention of a cow." Since the pronouncement of the "Lancet" was quoted as authoritative and well-informed, we deemed it right, in the interests of the gas industry, to show that it was neither the one nor the other. We had hoped that, in view of the facts which we cited, the "Lancet" would have made a withdrawal of the statements in its article, of which the following is an example:

> "At the present time, however, London gas contains still an amount of sulphur which cannot be overlooked in view of hygienic, artistic, and economical considerations. It averages about 24½ grains per 100 cubic feet. We are confident in saying that the biggest march forward that the gas companies could make in their own interests and in those of the public would be made by removing the whole of the sulphur impurities of the gas supply."

The removal of the whole of the sulphur compounds from gas is, and is likely to remain, commercially impracticable. Yet the "Lancet" in an editorial comment on Mr. Carpenter's letter says that it is most satisfactory to learn that one of our great gas-making companies intend soon to supply their gas *entirely free from sulphur compounds*. We were, of course, at the time we criticized the "Lancet's" attitude, fully aware of the excellent work which the South Metropolitan Gas Company have already accomplished and are doing in the perfecting and adoption of the Evans process for the removal of carbon bisulphide from coal gas. We are glad to see Mr. Carpenter's diplomatic letter published in the "Lancet;" and the more widely the Evans or any other economical process for the removal of carbon bisulphide is adopted in gas-works, the greater will be our gratification. But the "Lancet" asked for much more than this or any known process will afford, and continues in the same strain in its editorial note this week.

The "Lancet" regarded gas containing only 24½ grains of sulphur per 100 cubic feet as mischievous hygienically and otherwise. Yet so low a figure as this has been achieved only by the adoption of processes which remove the greater part of the carbon bisulphide originally present in the gas. The South Metropolitan Gas Company's supply during last quarter contained on the average 23·4 grains of sulphur per 100 cubic feet, which is not much below the figure which the "Lancet" took as the text for its homily. No doubt, when the Evans process is applied to the whole of the Company's gas, this figure will be substantially reduced, as is shown from the fact that, in the last summary of testings issued by the London County Council, the sulphur at one of the testing-places of this Company averaged as low as 14·5 grains per 100 cubic feet [though it may be remarked that at another testing place, where the effect of the Evans process was not felt, it averaged as high as 42·6 grains].

If the "Lancet" cannot distinguish between the removal of the whole of the carbon bisulphide and the removal of the whole of the sulphur from gas, it cannot pretend to write authoritatively on the sulphur question; and until it has retracted its misleading statements as to the removal and the harmfulness of the sulphur in London gas, we cannot regard its own record as qualifying it to make *ex cathedra* pronouncements on the "manners and intelligence" of the "JOURNAL." It has taken up in its last issue the attitude of censor of manners and intelligence in preference to combating the facts and arguments which we adduced against its original article. The inference is obvious.

Letter to the "Lancet" by Mr. Charles Carpenter.

The letter by Mr. Charles Carpenter, D.Sc., referred to in the foregoing, is as follows:

"The presence of sulphur in purified coal gas was known quite early in its history; but Dr. Brande was the first to point out that the compound was bisulphide of carbon. In 1860, the first Act of Parliament was passed fixing a maximum allowable amount for the impurity; and from that time onward large sums of money have been spent in complying with those regulations. The only practicable method of extraction was the so-called lime process, which, apart from being very unsuitable, created a good deal of nuisance. When, therefore, a Departmental Committee presided over by Lord Rayleigh reported that the removal of the carbon bisulphide was unnecessary, the companies hastened to revert to purification by oxide of iron. But, as you correctly state, they have since partially gone back to lime.

"Nearly six years ago the Chief Chemist of the South Metropolitan Gas Company was instructed to investigate *de novo* the whole subject of gas purification; and in the end a process based upon one suggested many years ago by Professor Vernon Harcourt was tried on the large scale. The experiment was successful; and at our second largest

works the whole of the gas made there—amounting to about 10 million cubic feet daily—has been for some months past purified from every trace of carbon bisulphide. The process is being extended to the remainder of our works; and in a year's time the whole of the gas supplied by this Company will be completely purified from bisulphide, treatment for which has so long baffled chemists and scientists.

"The full advantage as a sterilizer of the bunsen flame used in incandescent gas lighting will thus be obtained in our living and sleeping rooms, without any disadvantage arising from any excess of sulphurous acid from the products of combustion, which it is not possible to guarantee when only oxide of iron is used."

ELECTRICITY SUPPLY MEMORANDA.

We are not going to retraverse the disposal that we made last week of the references by the "Lancet" to the subject of sulphur dioxide or trioxide, and the happy rejoicing thereat of an electrical contemporary. Suffice it to say we are still waiting to learn what they have to advance as to the evil effects of such a proportion as 0·00245 volume of sulphur dioxide in 10,000 parts of air, the former arising from the combustion of coal gas containing 24¼ grains of sulphur per 100 cubic feet, and as to the London atmosphere containing normally 0·002 to 0·005 volume of sulphur dioxide in winter—not an insignificant part of this being contributed by the chimneys of the electricity generating-stations. There is an old adage as to looking before one leaps; and if our friends of the "Lancet" had looked a little deeper into the matter, they would have seen the folly of what they were writing. That there should be care in dealing with such subjects is clear from the fact that the "Lancet" succeeded in misleading "Meteor" of the "Electrical Times," who, it was observed, knows just about as much of the matter as a Fleet Street penny-a-liner. "Meteor," however, unconsciously gives a direct answer to the "Lancet," when he asks: "How 'sorts' all this with the frequent references of the gas journals to Harley Street? Are we to believe that these eminent medical specialists are ignorant quacks?" If "Meteor's" answer be in the affirmative then he accepts the "Lancet's" ill-considered tale; if it be in the negative, as it must be, then he accepts the large use by Harley Street of the calorific power of gas as a direct refutation of the "Lancet's" side-slip. It was rather an unfortunate thing for his argument, and for the cosiness he temporarily felt in being under the "Lancet" cloak, that "Meteor" should have dropped into a reference to Harley Street. However, he admits that gas is an admirable thing in its proper place; and that place he fancies is "at the root of the public supply in works equipped for distributing gas heat units in the form of electric kelvins"—dropping in the process all but the small fraction of the original calorific power of the gas that is electrically delivered at the point of use. "Meteor" was never mentally equipped for the *rôle* of an economist; hence certain peculiarities to which he gives birth, and with which we have to deal.

The Sulphur Bogey.

Domestic Electrification.

There comes a time in the annual history of various electrical contemporaries when they settle down to present their readers with information from various quarters as to how domestic electrification is proceeding in the matters of cooking and heating; and really we cannot see much difference between the tales of one year and the immediately preceding one. There is a wonderful similarity about it all: and a delightful vagueness overhangs much of it. This year, however, there are a few restaurants and business establishments that have put in electric cooking appliances about which to talk; some of which restaurants and business establishments have very close association of one kind or another with electricity supply undertakings. In reply to the inquiries of our contemporaries as to the cooking apparatus installed, it is a pity that station engineers do not discriminate between a sensible size of electric cooker and an egg-boiler in giving the number of cooking appliances in use; but they will not do so. Some of the engineers, too, report that the cooking apparatus connected up to their mains is giving every satisfaction; while others say they are not prepared to seriously prosecute the business, owing to the unreliability of the apparatus on the market. Some kind providence apparently watches over the affairs of those electrical undertakings whose consumers derive "every satisfaction" from their cooking appliances. From Marylebone, for example, there comes the report that nineteen double cookers are connected to the mains and two hundred domestic cookers. What is the character of these "cookers"? Are there any grillers, small boiling devices, and such-like among them? And does the Marylebone Electricity Department send every few days an electrical expert to examine the "cookers" fixed, in order to try to prevent them going adrift in service? In regard to heating, it is stated that in Marylebone, a large number of electric-heaters have been installed in the place of gas-fires. We should be inflicting unnecessary pain by making anything more than a passing reference to the number of electric-heaters all over the country that the gas-fire has disestablished, where consumers want heat, and a greater economy in realizing it without returning to the labour-creating and smoke-producing coal-fire. In order to enhance patronage of the electric-heater, the "Electrician" advises that a great point should be made of its healthfulness, as there is no doubt that at the present time gas-stoves are much objected to from this point of view. We suppose this is why gas undertakings are crying out for a larger supply of fitters to deal with the rush of work through the public demand for gas-fires. The healthfulness of the electric-heater is a thing that is much disguised. Fancy a heater the greater part of the heat of which is given off in the convected form being healthier than a type of fire the heat of which in major part is of the radiant brand. Moreover, the electric heater does not pretend to add to the healthfulness of a room by keeping the air in constant movement by the influence exerted on the chimney. We have carefully read the reports collected on the subject of progress, and really we cannot see that the electric cooking business has made any remarkable strides, nor that the Point-Five tariff has had any notable influence in this direction.

Thermometrical Regulation.

There has been a little heated discussion quite appropriately between Mrs. Cross and the writer of "Cooking and Heating Notes" in the "Electrical Times." The latter just recently discovered Mrs. Cross's pamphlet, "General Directions for the Use of Electric Cooking-Stoves," which was reviewed in the "Memoranda" for July 29 last. It was indicated by our review that it was an excellent pamphlet, at the low price of 2d., for distribution by gas suppliers, as it showed authoritatively that the supplanting of the plain, convenient, and reliable gas-cooker by the electric-oven meant the adoption of finical and more expensive methods of cooking, and that the electric-cooker and its hot-plate have limitations that are not present with the gas-cooker and its top plate. The pamphlet, therefore, does not come up to the expectations of the writer in the "Electrical Times;" and he has distressed Mrs. Cross by saying so. We will not again run over the ground of our former comment, which took somewhat the lines of that since made by the writer in our contemporary. There is, however, the interesting point as to the use of the thermometer in connection with the electric-oven. The electrical critic agrees with the previously expressed opinion of the gas critic that a thermometer as fitted in the electric-oven is of little, if any, value. In fact, he says that it is a superfluous attachment; and its readings do not represent, within 20° to 30°, the average temperature of most ovens. When one thinks of the little grease and steam covered bulb protruding inside the door of the oven, and the longer stem outside the door subjected to a different temperature, and possibly cold draughts, one is in perfect harmony on the point with our electrical compeer. But Mrs. Cross (the critics notwithstanding) sticks to her points as to the necessity of the thermometer, and so lays stress on a weakness of the electric-oven for ordinary domestic use. She emphasizes how carefully the heat of the electric-oven must be guarded when she says that, if a thermometer is not used, the door of the oven must be opened, and the heat will be lowered by at least 30°. "Unfortunate electric-oven! What an amount of nursing you do require." We agree with the commonsense rejoinder of the electric critic, because it is commonsense. He says: "We think most of our readers who are familiar with domestic matters will agree that the average housewife judges of the temperature of her oven, be it heated by gas, coal, or electricity by the crude test of opening the door, and placing her hand inside, and she does this whether there be a thermometer on the door or no. As an indicator of the average temperature of the oven, the thermometer is of very little value, and may be, and frequently is, a mischievous attachment." That is so.

A Temperature Problem.

But then the same writer goes on to show his electrical fangs. Commonsense one minute; exaggeration of prejudice the next. He says: "It must be remembered that in the case of gas, with its fluctuating pressure and heat value, combined with the absence of definite gradations in the heat control, there is the excuse for the employment of a thermometer." Yet thermometers are very rarely used, except experimentally, in gas-cookers. Yet, too, in the West-End hotels, restaurants, and the houses of the rich, thermometers are not employed in the gas-ranges, but the most delicately cooked edibles are turned out from them. How is this? Let him explain. Anyone can say it is not so; the proof that it is not so is quite another matter. We want this writer of cooking and heating notes in our electrical contemporary to address himself to another matter, in order to prove the deliberate assertion that he makes, when he says: "It must be remembered that in the case of gas, with its fluctuating pressure and heat value," and so on. In the case of gas supply, it is easier to guarantee the heating value of gas than its luminous value *per se*—that is, without the intervention of a mantle. The electrical writer suggests that in the case of a gas-oven, fluctuating pressure causes a variation in the heat values. Now we should like him to explain first how he thinks that (say) in a domestic establishment the pressures jump up and down vagariously in the manner that he assumes. Let us suppose a road in which the pressure in the main is 3 inches (water gauge), the district governor being set to maintain, approximately, this local pressure. A gas-oven is started to consume a few cubic feet of gas per hour; the gas-jets are adjusted by the oven-taps. Suppose by some circumstance the pressure drops to 25-10ths, or 2½ inches, what difference would this make in the temperature of

the oven with a gas of (say) 520 B.Th.U. per cubic foot? Now let us warn our friend not to assume that because the district pressure has dropped ½ inch, that it will represent one-sixth difference in the consumption of the gas. There is a nice little calculation for our electrical friend who, with a dogmatism that shows a sufficient strength of will to tackle the little problem we have set him, speaks of fluctuating pressures and heat values in a gas-oven. The heat values do fluctuate by the adjustment of the taps, which give a temperature range (not a few more or less overlapping variations of temperature as in the electric-oven) that rejoice the heart of the expert cook—other possibly than Mrs. Cross. We will not point out the pitfalls that assail our friend in tackling the problem we have set him. They can be left for use, if need be, later on. We do, however, look to him to justify his statement regarding variable pressures and heat values.

Slow Water Heating.

This is a matter, as we were recently pointing out, that has a fascination for some dabblers at the problem of how to fit a physical incapacity of electricity to the performance of one of the worst heating processes to which it could be applied. It has already been suggested that electricians might better employ their time in other directions than in this particular one. Joining the little array of incompetents in this line—incompetent to keep pace with human requirement—is the Ferranti water-heater, which, it is stated by those who desire to find a market for it, fulfils the conditions of furnishing quickly a sufficient quantity of hot water for domestic purposes, while purchasing energy at the minimum rate. It is asserted in the case prepared for advancing the claims of the heater that for domestic purposes the usual demand is for 20 to 30 gallons of hot water per twenty-four hours, drawn at varying intervals and in varying quantities. In this estimate there does not seem to be any provision for warm baths of (say) 25 gallons each. From the structural details, we learn that a small cistern is provided fitted with a ball-valve, and fed by a cold water pipe. This cistern discharges into the lower part of a tank electrically heated. The hot-water supply-pipe is connected to the tank near the top. The electrical heater is rated at 300 to 400 watt-hours, and surrounds a vertical heater-pipe. Switching on the current, the infinitesimal quantity of water in the heater-pipe quickly heats up, its level rises, and the heated drop eventually overflows on to the top of the cold water in the tank. We should imagine that it receives a sudden chilling shock. But we go on to see how a cycle of operations is established. The passing of the hot drop of water allows an equivalent amount of unheated water to enter the bottom of the heater-pipe, and a second overflow takes place as soon as the desired temperature is attained. So we go on; and by some providential intervention in the struggles of the drops of heated water to keep hot and the cold foundation to extract warmth from them, "a small quantity" of heated water "is available half-an-hour after the start, from all cold." Hurrah! If no water be drawn off for a lengthy period—say, during the night—the tank becomes full (quantity not stated) of heated water at various temperatures. Remarkable! In the notice of this and other electric water-heaters of the slow operating type, it is striking how often one meets with the word "advantage," which always seems as though in this connection it has lost a prefix.

GAS ACTS FOR 1913.

[Second Article.]

Pursuing the same course as in the first article, of merely pointing out the departures from the Bills as disclosed by the Acts, we deal with the remaining measures of the promoting statutory gas companies. The Bills were dealt with either in the "Journal" for Jan. 14 last or in that for Jan. 21.

The Act of the Harrow and Stanmore Gas Company shows that the measure passed through Parliament with very little change from the original form. The scheme for the consolidation of the capital has been approved; and the terms applying to it remain as when the Bill was noticed on Jan. 14. We get right down to the borrowing powers before discovering any variation. It was proposed that the borrowing powers in respect of the 1903 capital and the additional capital should be on the usual basis of one-third part. In regard to the additional capital, the proportion is as stated; but in relation to the ordinary and preference stock into which the share capital is consolidated, the borrowing (inclusive of £45,799 already borrowed) is not to exceed the sum of £52,250 The authority for new works, bridge construction, &c., has alı been conferred; but in connection with the transporting appliances between the South Harrow branch of the Metropolitan Railway and the works of the Company, it is stipulated that any mains, wires, and other works and apparatus are to be so constructed, maintained, and used as to prevent any interference with any telegraphic line belonging to, or used by, the Postmaster-General. The Harrow-on-the-Hill District Council have also obtained protection. The workmen's benefit fund and profit-sharing clauses have been passed. A clause now appears providing that the price chargeable for gas supplied to public street lamps is not to exceed a sum which is 4d. per 1000 cubic feet less than the price per 1000 cubic feet generally charged by the Company to private consumers. No other variations call for notice. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Herne Bay Gas and Electricity Company, Limited, is the name conferred upon the Company by their new Act. They have secured the electricity powers described in the notice on Jan. 14 of the provisions of the Bill; and the agreement entered into with the District Council has been ratified. The charges that the Company are authorized to make for electrical energy are of interest. They are, according to the third schedule: For any amount up to 20 units supplied for the purpose of lighting 10s; and for each unit over 20 units, 6d. For power purposes, the charges are not to exceed 6s. 8d. up to 20 units; and for each unit over, 4d. In the body of the Act, it is provided that, with the consent in writing of the Council, the Company are to be entitled to charge rates per quarter not exceeding up to 20 units 13s. 4d.; and for each unit over, 8d. The consent of the Council is not to be unreasonably withheld; and if any question arises, it is to be determined by arbitration. The remaining clauses do not vary from the review of the Bill in the "Journal" already mentioned. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Examining the Redcar, Coatham, Marske, and Saltburn Company's Act, we see that, from the construction and maintenance of works clause, the words "by them" have been deleted. The proposal that the standard illuminating power of the gas shall be 12 candles has been confirmed; but the clause might just as well have been expunged, although it can neither do harm nor good, inasmuch as a calorific power standard has been inserted. It would have been preferable had the terms followed the South Suburban model, in respect of B.Th.U. and gross value. As it is, the clauses provide that the gas supplied by the Company shall be 125 calories net per cubic foot (496 B.Th.U., or, say, 500, to adopt round figures); but the Company are not to incur any liability in the event of the gas being of a calorific value of not less than 112 calories. Regarding penalties for deficiencies, the following terms apply:

> If on any one day the gas supplied by the Company at the testing-place is of less calorific power than 112 calories to an extent not exceeding 7 calories, the gas examiner of any such local authority shall (if the local authority contemplate proceeding for a penalty) make at the testing-place a testing of the calorific power of such gas on each of the two following days, and the average of the three testings so made shall be deemed to represent the calorific power of the gas on such one day.
>
> The Company shall not be liable to any penalty for defective calorific power where the calorific power on any day of the gas supplied by them at the testing-place is not less than 112 calories; but where the calorific power on any day of such gas is less than such last-mentioned quantity, the Company shall be liable to the following penalties in respect of such deficiency—that is to say:
>
> Where the deficiency does not exceed 3½ calories, £2.
>
> Where the deficiency exceeds 3½ calories but does not amount to 7 calories, a sum not exceeding £5.
>
> For each complete 7 calories of defective power, a sum not exceeding £10.

From the stand-by clause, electricity has been removed, though in several other Acts it appears. The clause by which the Company sought to increase their capital has not survived. But under the borrowing powers, it is seen that they are authorized to raise (inclusive of the £7065 already borrowed) £24,016. Also in respect of the capital authorized by the Act of 1878, and not already raised, any sum may be borrowed not exceeding in the whole one-third part of the amount of such issued capital. The dividends have now been regulated as follows: On the original ordinary £10 shares, issued under the Acts of 1876 and 1878, on the ordinary "A" shares of £10 each issued under the Act of 1878, and on the ordinary shares of £10 each created by that Act, but not yet issued, 10 per cent. on the amount actually paid up; and on the ordinary "B" shares and the ordinary "C" shares of £10 each issued under the Act of 1876, 7 per cent. A standard price of 3s. 4d. has been included, with the sliding-scale on the ordinary terms. The other powers sought remain the same as mentioned in reviewing the Bill. [*Parliamentary Agents: Messrs. Durnford and Co.*]

The Slough Gas Company are to be congratulated. Their capital consolidation scheme, new capital powers, extension of limits, and all else, except a couple of minor details, have gone through precisely as stated in the account of the Bill published on Jan. 21 last. The proposal to set aside £60 each half year (until an aggregate of £2000 had been reached) as a capital redemption fund has not been accepted. At the instance of the Eton Rural District Council, a clause has been inserted in favour of Datchet, Burnham, part of Farnham Royal, and part of Stoke Poges, providing that the Company are not to be entitled to charge a higher price than that for the time being ordinarily charged by them in those parts of their limits of supply not within any of the areas named, unless they can prove to the reasonable satisfaction of the Eton Rural Council that for the preceding twelve months they have not received in respect of the gas supplied by the mains in the area an amount equal to 10 per cent. on the capital outlay incurred in the laying of the mains—such amount to be calculated on the price ordinarily charged within those parts of their limits of supply not within the areas mentioned. The Great Western Railway Company and the Grand Junction Canal Company have both obtained protecting clauses. [*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, & Co.*]

The disability under which the South Staffordshire (Mond Gas) Power and Heating Company laboured in respect of the issue of

new capital, owing to the fact that up to the year 1911 they had only paid one dividend of 1 per cent. on the ordinary capital, has been lightened by the new powers which the session has placed in their possession. They are now empowered to issue one-half of the share capital authorized in 1901 as preference capital entitled to a cumulative preference dividend not exceeding 6 per cent. per annum. The other powers which were asked for, as traced on Jan. 21 last in our review of the Bill, have been granted; the only alteration that is of general interest being the modification of the proposal as to a stand-by clause, which now reads:

(1) Notwithstanding anything contained in the Act of 1901 or any other Act, no person shall be entitled to demand from the Company a supply or increase of supply, in cases where the same is required for short or intermittent periods, if the affording or continuing of such supply would interfere with, or jeopardize, the Company's general snpply within the district. Provided that in case of any dispute between the Company and any such person as to the applicability of the provisions of this section to the supply or increase of supply demanded by such person, such dispute shall be determined by arbitration under, and in accordance with, section 28 of the Electric Lighting Act 1882.

(2) Nothing in this section shall be deemed to entitle the Company during the continuance of any contract existing at the date of the passing of this Act to decline to give, or to continue to give, any supply which the Company may be bound to give or to continue to give thereunder.

There is nothing else requiring special notice. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Tottenham and Edmonton Gas Act was the gas measure of the session; and it is rare that one of such magnitude as this issues from Parliament with so small an amount of alteration as is found in it, when contrasted with the Bill as lodged. The Enfield Gas Company's undertaking is to be transferred on the terms set out in the notice of the Bill on Jan. 21 last; and all matters of consequence relating thereto are maintained in the original form. It is seen that a testing-place is to be provided in Enfield Town from the time that the testing-place at the Enfield works is discontinued. From Jan. 1 next, the Company will bear the title of the Tottenham District Light, Heat, and Power Company. The authorization regarding the electricity supply scheme for Wood Green has been fully obtained; and the Company are empowered to negotiate and enter into agreements for the transfer of the undertakings of other electricity authorities. Looking through subsequent interesting clauses of the Act, the only one we miss is that by which the Company sought relief from the obligation to give a supply from any main for any purpose other than for lighting or domestic use, in any case where the capacity of the main was insufficient for the purpose, and so long as the supply would, in the opinion of the Company, interfere with the sufficiency of the gas required for lighting purposes. This clause has been deleted. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Tynemouth Gas Company did not have much trouble over their modest Bill, though there was a little controversy as to the co-partnership clauses. The extension of the limits of supply has been vouchsafed; and the co-partnership scheme has been endorsed. The only thing that has been sacrificed since the essential features of the Bill were noticed is the proposed authorization as to the supply of power gas. This does not appear. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

As the Westgate and Birchington Gas and Electricity Company must now be known the Company who, in those areas, have only been carrying on the business of gas suppliers. The Act shows little deviation from the Bill deposited. The limits of gas supply have been extended; the collection of miscellaneous ordinary clauses have been allowed; and the electricity supply powers sought have been granted. The capital, profit-sharing, and other clauses remain precisely as they existed when we reviewed the Bill; so that there is no occasion to reproduce the particulars. [*Parliamentary Agents: Messrs. Lees and Co.*]

By their Act, the Worthing Gas Company have obtained relief from the peculiar position in which they were placed by the litigation respecting the laying of a main, and the interference with a tunnel, in Goring Lane, the owner of which tunnel is Mr. Paul Ernest Schweder. The work can now be done, subject to compensation. Mr. Schweder has had various protecting conditions embodied in the Act. There are to be no additional mains or pipes laid under the powers of the Act placed through or across the tunnel at a lower level than the gas-mains shown upon a signed plan. Avoidable damage to property is provided against; and the making good of any damage occasioned under the powers of the Act is a condition. The user of the tunnel and its approaches is not to be impeded during main-laying operations to a greater extent than is reasonably incidental to the work. There is also a clause in favour of the Company limiting compensation in respect of new buildings, or alterations not made *bonâ fide*. [*Parliamentary Agents: Messrs. Dyson and Co.*]

"Coal Tar Distillation."—We have received from the publishers, Messrs. John Allan and Co., a work by Mr. Arthur R. Warnes bearing the above title. The author deals in a practical manner not only with the distillation of tar, but also with the working-up of the chief residuals. The book, the price of which is 7s. 6d. net, will be noticed more fully in a subsequent issue.

BRITISH COMMERCIAL GAS ASSOCIATION.

The Proceedings of the General Committee.

At a well-attended meeting of the General Committee, under the Chairmanship of the new President (Bailie Paxton, of Glasgow), held in St. Ermin's Hotel, last Thursday, some interesting business was carried through.

A letter was read from the Belgian Institution of Gas Engineers thanking the Association for the generous hospitality which had been extended to their visiting members, and expressing hearty appreciation of the conference arrangements, and the remarkable display at the National Gas Exhibition.

Twenty-one international members were reported as having expressed a desire to join the Association, and were duly enrolled. The new members represent undertakings in America, France, Denmark, Germany, Holland, and Italy.

It was reported that a Special Sub-Committee has been appointed to consider various ways and means for increasing the sale of coke, and to co-operate with the London Coke Committee for this purpose.

A resolution of sympathy was passed regarding the death of Mr. C. E. Botley, of Hastings, who was a member of the General Committee; and it was unanimously resolved that Mr. C. F. Botley should be appointed as one of the Southern District representatives, in his late father's place. Mr. J. W. Helps, of Croydon, was added to the list of Vice-Presidents. It was also agreed that, under the new rules, Mr. T. Waddom, of Newcastle, and Mr. W. D. Helps, of Leeds, should be appointed as additional members to act on the Executive Committee.

It was resolved that district conferences should be inaugurated, to stimulate interest in gas matters and in the work of the Association in various districts, and that Special District Committees be organized for carrying out the necessary arrangements. The meetings will, it is intended, be held between the annual conferences of the Association.

The date of the next annual conference, which is to take place in Glasgow, was fixed for the 13th and 14th of October, 1914.

PRESENT POSITION OF THE COKE MARKET.

A Suggestion by the Institution of Gas Engineers.

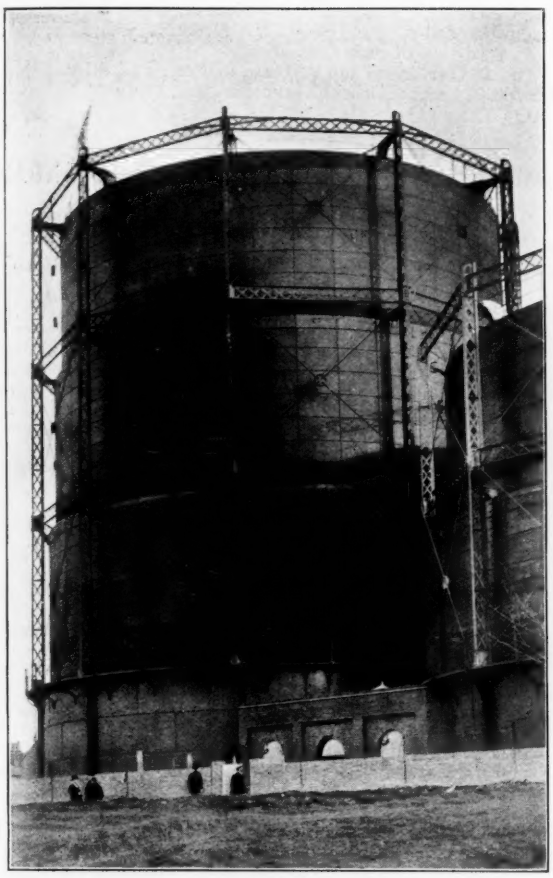
The question of the present position of the coke market has been under the consideration of the Emergency Committee of the Institution of Gas Engineers, and a letter dealing with the subject has been addressed to the members by the President (Mr. Edward Allen), who, as will be seen from the report which appears elsewhere, referred to the matter at the meeting of the Southern District Association last Thursday.

The Committee agreed that some difficulty is being experienced in the sale of coke throughout the country, that stocks are unusually heavy, and that prices are lower than is consistent with the state of the coal market. It was considered that there were two main reasons for this state of things: Firstly, the increased output of coke from colliery coke-ovens, which, after supplying the requirements for metallurgical purposes, leaves a balance that competes with gas coke for greenhouse and general purposes; and secondly, the extra quantity of gas coke placed on the market in consequence of a reduction in the manufacture of carburetted water gas, and a corresponding increase in the output of coal gas. The substitution of coal gas for carburetted water gas not only makes 10 cwt. of coke for sale per ton of coal used, but leaves in stock fully 5 cwt. that would otherwise be used in the manufacture of carburetted water gas. It must also be remembered that the general increase of business in the gas industry has resulted in more coke for sale.

The Committee realized that the only direction in which to look for relief is in the greater use of carburetted water-gas plant; and they therefore suggest that these plants should be put into operation as far as possible. It was understood that the high price of gas oil during the past year or more has led to a reduced output of carburetted water gas. But the market is now easier; and a review of the whole position is favourable to the course recommended by the Committee.

With regard to the price of gas oil, the President says that it is probable that the very low figures reached in 1910 have exaggerated the ideas of the increase in cost of carburetted water gas caused by the enhanced price of gas oil since that date. Prior to 1909, the average price during fourteen years was nearly 3¼d. per gallon to gas undertakings near to seaports; and there is every reason to expect that this figure will be reached in the near future. But even the present price of gas oil should not, it is thought, hinder the manufacture of carburetted water gas, if due consideration be given to its collateral advantages, particularly that of reducing stocks of coke.

The Committee trust the communication will not be looked upon as intended to interfere with the administration of the undertakings under the control of the members, but simply as an effort to promote the interests of the gas industry, and fulfil its functions as representing all the gas undertakings of the country.



Photograph of a 250,000 cubic feet holder erected for the Harwich Gas Company, whose Resident Engineer is Mr. W. E. Jolliffe. The holder was designed by Mr. J. T. Jolliffe, of Ipswich, and erected by Messrs. Samuel Cutler and Sons. The inauguration ceremony took place last Tuesday; and a short account of the proceedings will be found in our news columns to-day (p. 694).

CONCILIATION IN LABOUR DISPUTES.

FOLLOWING up the reference lately made in the "JOURNAL" to the first part (dealing with strikes and lock-outs) of the Board of Trade report on industrial disputes in 1912, which was recently issued by the Labour Department, some figures may now be quoted from the second part, which is designed to furnish information as to the work accomplished during the twelve months by Conciliation and Arbitration Boards.

With so many industrial disputes as there were last year, a favourable opportunity presented itself, of course, for the setting up of a fine record in respect of the number of strikes and lock-outs settled by conciliation or arbitration; and the chance was not lost, for the number of disputes adjusted by these agencies was the highest so far noted. In addition to this, voluntary boards of conciliation and standing joint committees continued to increase in numbers; and by their efforts many disputes were settled without recourse to a stoppage of work. Of the 857 disputes which began in 1912, 89 (directly involving 71,308 workpeople, or about 6 per cent. of the total directly involved in all disputes beginning during the year) were settled by conciliation —that is to say, by the mediation of a third party or board—or by reference to arbitration. These figures do not, however, present an exact record for the year of the disputes settled by these means, as they include cases settled in 1913, while they do not include disputes beginning before 1912 which were settled during that year. Of the disputes settled by these means in the twelve months under review, nearly one-half occurred in the metal, engineering and shipbuilding, and textile trades, in each of which groups the number of disputes was considerably higher than the average for the preceding nine years.

The actual number of strikes and lock-outs settled by conciliation or arbitration during 1912 was 99, which compares with 92 for the preceding year, and 28 for 1903. Though this number was only slightly in excess of that of 1911, it was more than double the average number of disputes so settled during the period from 1903 to 1910. The number of workpeople directly and indirectly involved in these settlements was somewhat less last year than in 1911, when the big transport troubles occurred. Conciliation was again last year the favourite mode of settlement; arbitration accounting for only 23 out of the 99 disputes adjusted. As to the operation of the Conciliation Act of 1896, the number of cases involving stoppage of work settled by conciliation under the provisions of this measure showed a considerable decline as compared with the previous year; but the number settled by arbitration under the Act was unusually high.

The figures so far given refer solely to those disputes where an actual stoppage of work occurred which were settled by conciliatory agencies, including voluntary permanent conciliation boards and standing joint committees. But these boards and committees are, of course, primarily intended to prevent stoppages, and therefore much of the work done by them does not appear in the above statistics. To take the complete record, the number of these permanent boards and committees known to have taken action during 1912 was 164; and the cases considered by them totalled 3083. These figures compare with 4543 cases considered by 126 bodies in 1911. No less than 1905 of the cases were settled by the boards and committees, and 233 by umpires or arbitrators appointed by them; and of the total number of disputes thus settled by the instrumentality of the boards, only 16 involved any stoppage of work—two of these instances being in the coal-mining industry. It is recorded that the number of cases considered by boards and committees in the mining and quarrying industries in 1912 was less than in previous years, mainly owing to a decline in those dealt with by the Joint Committees in the Northumberland and Durham coal trade. Many cases, of course, referred to only a few workpeople; but, on the other hand, the only case settled during the year by the Coal Conciliation Board for the Federated Districts affected about 390,000 persons. A number of new boards and committees were established in 1912; and some half-dozen ceased to exist. Under the terms of the Coal Mines (Minimum Wage) Act, 1912, Joint District Boards were established in 22 districts for the purpose of carrying out the provisions of the Act; but as these are not voluntary boards, no particulars of their proceedings are given in the report under notice.

ESTIMATES AND VALUATIONS.*

THE book under review consists for the most part of tabulated prices required by the gas engineer when estimating the cost of new buildings and plant. The published figures are the result of the author's experience, extending over a period of thirty years. He claims, and we think rightly, that there is a demand for such a publication. Hitherto the gas engineer has been compelled to rely for such data—apart from his own experience—on builders' price books, makers' catalogues, and the Technical Press. This is not satisfactory; and for this reason we consider that the book will be well received.

The author in his preface refers to the "success of the origina issue" of Moon's Gas Engineers' Price Book; indicating that, in his view, there is a demand for data of this sort. Whether this be so or not, the author supplies the want in a very adequate manner. It would appear as though the book under review is intended to take the place of the second edition of Moon's book; otherwise the author would hardly refer to the latter as the "original issue." The publication is modest in size, numbering 103 pages in all. It is well-indexed; and the whole subject is, generally speaking, well proportioned, without padding of any description. A third of the book is devoted to "Building Works," the remainder treating of "Gas-Works Plant," from retort-settings to prepayment installations. The ground covered is fairly complete, considering the size of the work.

There appears to be little enough to criticize. We have checked quite a large number of the figures quoted by the author, and, so far as these are concerned, could not anywhere find ourselves in disagreement with him. To some extent it seems to us that under "Building Works" a good deal is included that could equally well be obtained direct from Lockwood's or Laxton's Builders' Price Books. It may, of course, have been the intention of the author to include in his book the whole of such figures so far as they refer to building in gas-works, irrespective of whether they can readily be extracted elsewhere. We will not, however, quarrel with him on this score.

More data should be given of the cost of retort-settings, both on the horizontal and vertical systems. The information supplied is of the briefest description, and disproportionate to the importance of the subject. There is room for improvement here. The same may be said of the figures relating to carburetted water-gas plant. A half-page only devoted to such a subject is quite inadequate; such brevity renders the figures inconclusive and the reverse of clear. It is noticed, too, that in giving the cost of condensers, scrubbers, and purifiers, the author appears to have omitted any reference to foundations. Apart from these criticisms, the subject matter is well treated throughout, sufficiently so to render this new publication of good service to gas engineers and others who will have occasion to use it.

In conclusion, it should be mentioned that, in an introductory note, Sir Corbet Woodall testifies to the author's qualifications for dealing with such a subject, and indicates to engineers and managers the necessity of having reliable data at command for the purpose of making estimates for works and plant. We can confidently recommend the book as an acquisition to the gas engineer's library.

* "A Handbook of Data and Prices for Gas Engineers," by Jesse F. Scott, Assoc.M.Inst.C.E. London: John Allan and Co.; 1913. [10s. 6d. net.]

WORKS TOPICS—VIII.

By Modus Operandi.

Some gas engineers, even at this stage of the development of the continuous vertical retort, are sceptical of the advantages of this system as compared with horizontal retorts. At the same time, the progress made in the past two years by the two firms most closely connected with this type of retort—Messrs. Woodall and Duckham, and West's Gas Improvement Company—is so substantial that none but the most conservative of gas engineers can remain for long oblivious to the manifold advantages of this system.

I have been curious to trace the number of installations of continuous vertical retorts of these two types that have been erected since March, 1912. It was about this time that so many engineers were becoming convinced of the decided superiority of this system of retorting coal. The following figures show more eloquently than words the progress achieved so far as orders are concerned.

	Number of Installations.		
	March, 1912.		November, 1913.
Woodall-Duckham	20	..	46
Glover-West	18	..	52
	38		98

It must be generally conceded that this progress is extraordinary, especially having regard to the difficulty of altering existing plant. It would appear as though many engineers must have been biding their time until the new system had justified its existence. This it has now more than done, if the number of plants adopted be any criterion. Many engineers of the highest reputation have put in large plants—so much so that I venture to state that any engineer who at this stage of the development of the continuous vertical retort fits up a new retort-house with horizontals, lays himself open to the criticism both of his colleagues and of his directors or committee. Two years ago the boot would have been on the other foot; for then the engineer installing verticals was somewhat of a pioneer. It needs considerable courage to recommend the expenditure of a large sum of money on a new system; but to recommend the adoption of an obsolete type of plant calls for equal courage. Most engineers will have no hesitation in following the example of the many prominent men who have associated themselves with this method of carbonization.

In many of the works that now have verticals, there were formerly old-fashioned horizontal settings without machinery; so that, in such cases, it was very profitable to replace them with vertical retorts. But where there exist machine-worked horizontal settings of modern type, the position is entirely different. In such cases the replacement of the plant needs the closest consideration. And further, in many works this state of affairs is likely to remain for many years to come; for coal and coke handling plant, machinery, arches, regenerators, and bench ironwork, such as are used with modern horizontals, do not wear out under (say) fifteen years. Even then the renewal of the different parts of the plant is not coincident.

It is galling to the progressive engineer to feel that he is not justified in advising the adoption of plant which will give better results all along the line. If a horizontal retort plant has cost £100 per ton of coal carbonized per diem, it is quite clear that interest and depreciation at the rate of (say) 10 per cent. must be earned by the installation. Taking the working days of the plant as being 200 per annum, and assuming that the make per ton is 12,000 cubic feet, it will be evident that the cost of interest and depreciation, apart from wear and tear, will be 1d. per 1000 cubic feet. This must be earned until the initial outlay is entirely redeemed, even if the plant be pulled out. So that if this is to be possible the new plant must needs be a very profitable one.

In the case of continuous verticals, the plant costs about £150 per ton of coal carbonized per diem. Thus the interest and depreciation will, if calculated on the same basis, amount to 1½d. per 1000 cubic feet. Therefore, in the case of a vertical installation replacing modern horizontals, there may well be levied on the new plant a capital and depreciation charge of 2½d. per 1000 cubic feet. In some cases this would swallow up any additional profit from the working of the verticals.

Fortunately for the progressive engineer, there is often some factor of outstanding importance which enables him conscientiously to recommend the adoption of verticals—such as the very important matter of space occupied per unit of output. The well-known and peculiar circumstances of the Belfast works is a case in point. Here, it will be remembered, the Corporation had practically decided to build new gas-works, on an entirely different site, which would have entailed enormous expense, and the consequent probability of a higher price of gas for many years, owing to greatly increased capital charges. This was all saved by the prompt action of their newly-appointed and able Engineer, Mr. J. D. Smith. His policy was to convert his existing settings to continuous verticals, and thereby make about two-and-a-half times more gas on the same area. In such cases, the extra cost of verticals is a matter of, virtually, little importance.

Again, there is the matter of nuisance caused to neighbours, and the resulting restrictions placed on engineers in the matter of extensions and progress generally. Here this system steps in and finds a way out of such difficulties.

The further discussion of these matters, and other points of interest in connection with vertical retorts, must now be left for a future occasion.

THE PENTANE LAMP AS A WORKING STANDARD.

By E. C. Crittenden and A. H. Taylor.

[**From the "Journal of the Franklin Institute" for November.**]

For several years an investigation of various flame standards of candle power has been in progress at the Bureau of Standards [Washington]. This investigation has been made with the double purpose of determining whether any of the flame lamps are capable of furnishing a check on a possible drift in the value of the unit now maintained by electric incandescent standards, and of finding a satisfactory working standard for use where electric standards are impracticable.

The results have been distinctly favourable to the use of the Harcourt ten-candle pentane lamp as a secondary standard. This lamp has the disadvantages of being large and not easily portable; of using fuel which is expensive and somewhat dangerous; and of requiring more air than ordinary ventilation will supply. In spite of these faults, its use is increasing, chiefly because it appears to be the only standard of candle power now in use, other than incandescent electric lamps, which can be relied upon to give, under the usual working conditions, the degree of accuracy expected in present commercial practice.

A given lamp will repeat its value very closely; but the normal candle power is usually not exactly ten, and the exact value must be determined by a photometric test. Since the lamp itself is only an instrument for producing the actual standard (the flame) there is little significance in a value given for the lamp unless other factors—such as air and fuel and other conditions of operation—are known. The value certified for a lamp applies strictly only for its use under conditions identical with those under which it was standardized. A large part of the paper on the subject about to be issued by the Washington Bureau of Standards is devoted to a description of the method of testing followed at the Bureau and to general directions for the use of the lamps.

Especial attention is given to the effects of variation in pentane and of atmospheric conditions. It is found that the pentane commercially obtainable increases in density rather rapidly by the fractional distillation which occurs in the lamp. The density (at 15° C.) should be between 0·6235 and 0·626; but it usually reaches 0·635 when a little over half of the liquid has been used. Beyond this point there is a marked increase in the intensity of the flame as the density of the fuel becomes greater. For an approximate correction, which will make possible considerable economy in fuel without much sacrifice in accuracy, the variation may be assumed to be linear, and to be 1 per cent. in candle power for each 0·01 in the density of the liquid.

When the lamps are operated in a well-ventilated room, the most important cause of variation is humidity. Water vapour in the air lowers the intensity of the flame; the decrease being proportional to the amount of vapour. Since variations due to this cause may exceed 15 per cent., the water vapour correction is very important. Previous work at the Bureau has indicated that 1 per cent. of water vapour in the air causes a decrease of 5·67 per cent. in the candle power of the pentane flame, whereas the correction officially established in England is 6·6 per cent. The paper will give further data based on about 75,000 photometer settings on 27 lamps, including all those tested in 1911 and 1912, whose tests have extended over a range of 0·5 per cent. or more of water vapour in the air. The mean result is an exact check of the correction factor previously found at the Bureau.

To facilitate the reduction of observations on flames to normal candle powers, a chart will be given from which the departure of a lamp from normal value can be read directly when the barometric pressure and the readings of the wet and dry bulb thermometers of a ventilated hygrometer are known. The chart is plotted for the pentane lamp; but it may be applied to other flames without introducing serious errors. It would certainly be justifiable to measure gas-flames, for instance, with electric standards, and to correct the observed candle powers to obtain normal values according to the chart.

Absorption of Light by Lamps and Globes.—In an article in the "Electrician," Messrs. A. J. Makower and U. A. Oschwald gave some comparisons of the distribution of light from bare and half-frosted lamps of various makes. The amount of light absorbed in the lower hemisphere varies according to the structure of the filament, being different in the case of carbon and metal filament lamps. There are considerable variations in the results obtained with different makes of carbon filament lamps. In general, half-frosting reduces the mean hemispherical candle power by about 10 to 20 per cent. In a paper read before the American Illuminating Engineering Society by Mr. Preston S. Millar, the percentage absorption of various globes is given as follows: Frosted, 6; light opal, 13; dense opal, 22.

SOUTHERN DISTRICT GAS ASSOCIATION.

Autumn Meeting.

THE Autumn Meeting of the Association was held at the Hotel Cecil, Strand, last Thursday—the PRESIDENT (Mr. H. O. Carr, of Wandsworth) in the chair. There was a large attendance of members and visitors.

THE ASSOCIATION'S LOSSES.

The PRESIDENT said that before they proceeded with the *agenda* he had a very sad duty to perfom, and that was to record the loss by death of two respected members—Mr. C. E. Botley, of Hastings, and Mr. T. E. Pye, of Chichester. In Mr. Botley they had lost a valuable member—one of the founders of the Association, and a Past-President. He contributed several useful papers, and joined in the debates. His bright personality always commanded their admiration; and he would be greatly missed by the members, who would always remember he did all in his power for the profession, and to uphold its dignity. To-day they mourned for him, but his memory would remain. Mr. Pye, whom they also mourned, had contributed several useful papers to the Association; and one he wrote on the subject of advertising was a great incentive to the formation of the British Commercial Gas Association. In his younger days, he knew Mr. Pye well, as they were both in the Commercial Gas Company; and he was aware of his ideals and aims. He had shown them all an excellent example in battling against odds. He proposed a sincere vote of condolence with the respective families.

This was agreed to by the members silently rising in their places.

MINUTES OF THE LAST MEETING.

The HON. SECRETARY (Mr. W. E. Price, of Hampton Wick) presented the minutes of the last meeting; and they were taken as read and confirmed.

DISTINGUISHED VISITORS.

The PRESIDENT remarked that they were all very glad to have with them that day Mr. Edward Allen, the President of the Institution of Gas Engineers. Among the other visitors he welcomed was Mr. John Young, of Hull, the Vice-President of the Institution, and Mr. George Clarry, of Cardiff.

ELECTION OF OFFICE BEARERS.

Mr. J. T. JOLLIFFE (Ipswich), in proposing that Mr. Thomas Glover, of Norwich, should be the President for the ensuing year, said he was sure the members would receive the proposition heartily. Mr. Glover and his work were well known to all of them. He was a Past-President of the Institution, and those who had visited Norwich had seen the wonderful work that he had done there.

Mr. W. N. WESTLAKE (Exeter) seconded the proposition, remarking that during the time he had known Mr. Glover he had recognized his genial personality, as well as his marked ability.

The resolution having been carried with applause,

Mr. GLOVER thanked the members for the honour they had bestowed on him. He said he was not anxious for office, but was always wishful that the work of the District Associations should go on; and one could not but sympathize with the secretaries and members of committee who had to look for presidents. Perhaps it was this feeling of sympathy with their Secretary that induced him to consent to become President. He could only say that whatever ability he possessed he would place at the disposal of the Association; and he would do what he could to keep the proceedings up to the very high standard which they had so far maintained.

Mr. A. F. BROWNE (Vauxhall) proposed the election as Vice-President of Mr. J. W. Auchterlonie, of Cambridge, who, he remarked, was well-known as an engineer of standing and repute. He had served on the Committee, where he had been noted for his regular attendance and sound advice and assistance.

Mr. A. CADDICK (Croydon) seconded the proposition, which was agreed to.

Mr. AUCHTERLONIE, in acknowledgment, said it was with considerable hesitancy that he agreed to take office, for he could not be considered now as being in the Southern Association district. He would, however, do his best to support Mr. Glover in his year of office.

On the proposition of Mr. F. W. CROSS (Lea Bridge), Messrs. W. B. Farquhar, G. M. Gill, and P. S. Hoyte were elected members of the Committee.

A CHANGE OF SECRETARY.

The PRESIDENT said their friend Mr. Price wished to relinquish the post of Hon. Secretary. It was for a very excellent reason—because he had been elected to the high position of Hon. Secretary of the Institution of Gas Engineers, the duties of which they all knew from experience he would carry out with rare distinction. With the members' consent, however, they would not be entirely deprived of Mr. Price's valuable services, as he was still going to aid them on the Committee. Mr. Price had a great many good qualities [" Hear, hear "] ; but he would mention only a few. His tact, charm, and humorous geniality had won for him a great popularity. He had also a very large fund of shrewd commonsense combined with a cordial frankness which had always ensured the greatest respect among the members. He had, in fact, the science of pleasing. Personally, he (Mr. Carr), as did other Presidents of the past, thanked him for his excellent advice and assistance in carrying out the duties of the position. It was therefore with the greatest confidence that he asked the members to pass the resolution which he would read, and to have it placed upon the minutes of the Association. In doing so, he assured Mr. Price that in his new position he took with him the goodwill of the members. The resolution was as follows:

The Southern District Association of Gas Engineers and Managers wish to place on record their high appreciation of the valuable services rendered by Mr. W. E. Price to the Association as Honorary Secretary from 1910 to 1913, and to thank him for the businesslike way, geniality, and tact with which he has carried out the affairs of the Association during that period. Furthermore, to wish him every success in the new position offered to, and accepted by, him, of Honorary Secretary to the Institution of Gas Engineers.

Mr. EDWARD ALLEN, who seconded the resolution, remarked that the loss of the Southern Association was the gain of the Institution. He was pleased to be with them that day as President of the Institution, and to tell them with what pride everybody regarded the work of the Southern Association. He was glad to think that in Mr. Price the Institution had secured a worthy successor to their friend Mr. Shoubridge, who, he believed, was also a member of the Southern Association. He would like to add that he was sure the Southern Association and the whole industry were going to benefit by Mr. Glover's presidency.

The resolution was carried with acclamation.

Mr. PRICE, in response, said it was difficult to reply in a suitable manner; but perhaps a few words said from the bottom of his heart would show them how much he appreciated the kind feelings which had been expressed. It was now getting on for four years since he succeeded their old friend Mr. A. F. Browne, who had been an ideal Secretary, and to whom he was indebted for much assistance. He had hoped to retain the position for many years, as he looked upon the work as one of the most pleasant duties he had to perform, for the Association was composed of " jolly good fellows." However, quite unsought for on his part, this other post had been suggested; and after consideration, he felt it was his duty to take it. If he had satisfied the members during his term of office, he was sufficiently thanked; and he would be only too pleased to render any assistance he could to his successor.

The PRESIDENT then proposed the election of Mr. H. C. Head, of Winchester, as Hon. Secretary. He said that Mr. Head was in every way qualified for the position. He was already Chairman of the Commercial Section; and they knew with what great satisfaction he had filled the presidential chair two years ago. He was, moreover, personally acquainted with practically all the members. The members would doubtless unanimously elect him, and give him at the same time their grateful thanks for having so generously consented to accede to the wishes of the Committee to stand as a candidate. He would have a very difficult task to follow in Mr. Price's footsteps.

Mr. H. W. WOODALL (Bournemouth) seconded the resolution, which was cordially agreed to.

Mr. HEAD suitably acknowledged his appointment.

NEW MEMBERS.

The following new members were then elected: Mr. Arthur Herbert Andrews, of Sittingbourne; Mr. Henry Burgess, of Sidmouth; Mr. Frederick J. Bywater, of East Greenwich; Mr. Percy Drewett, of Fareham; Mr. Leonard J. C. Geer, of Goring-on-Thames; Mr. William Phillips, of Luton; Mr. Claude Russell, of Bexhill-on-Sea; Mr. William J. Sandeman, of Croydon; Mr. Frederick L. Schofield, of Barnstaple; Mr. William P. Tervet, of Devonport; Mr. John Urquhart, of Dorking; and Mr. Reginald A. Helps, of Croydon.

THE COMMERCIAL SECTION—COKE AND OIL PRICES.

Mr. R. S. TOBEY (Horley), the Hon. Secretary of the Commercial Section of the Association, gave a brief account of the work done by the section, which he said had been successful in securing its aims. There were, he said, now 58 members.

Mr. F. C. TAYLOR (Shanklin) moved the adoption of the report of the Commercial Section.

Mr. R. BEYNON (Torquay) seconded, and said he was quite certain that if all undertakings could realize the advantages to be gained, a far greater number would join. They had had special difficulty in persuading those in the south-western area of the Association to come in.

Mr. ALLEN remarked that he would like to say a word on this matter of Commercial Sections. He warmly congratulated the Association on the work being done by their Commercial Section, particularly in regard to the sales of coke out of their own districts. The circumstances of the supply of coke to London were far from being satisfactory; and, as the President of the

Institution, he had that day arranged for a letter to be sent to those undertakings, or to the representatives of the undertakings, who supplied coke to the London district, asking them to take part in a conference, to be held on Monday, Dec. 1, at three o'clock, at the Institution offices in Victoria Street, to discuss the question of coke supplies to London. It was quite evident that, on comparing notes of prices, much injury was being done to the industry. He was not referring to those only who made coke in the district, but coke was offered from other parts at absurd prices. They did not want to make a "ring," but to maintain fair prices. Anybody who had sold coke, or was selling coke in London, he hoped would come to the conference. He had also addressed a letter as President to all undertakings having water-gas plants. The high price of oil had, as they knew, led some of them to reduce the quantity of water gas manufactured; and this had put on the coke market an amount equal to 15 or 16 cwt. for every ton of coal used to make gas that would otherwise have been supplied from the water-gas apparatus. This was having a most depressing effect on prices, and in his letter he had called attention to the advantage of all undertakings making proper use of their water-gas plant. He was already assured in some cases that this would be done. There was no doubt that in the next few months they might look on something like 3½d. per gallon as the price of gas oil. Other sources were being drawn upon; and they might expect a reduction very shortly. They got rather alarmed in buying at higher prices; but it had been up before, and had come down. He thought if the price of oil would keep in the neighbourhood of 3d. they would get no injury by making a quantity of water gas. What he had done was in the interest of the industry; and he was sure that the matter deserved attention.

The PRESIDENT said they were all exceedingly obliged to Mr. Allen for his remarks. He only hoped that his ideas as to the price of oil would be fulfilled, and that it would come down even lower than he had stated. With regard to coke coming into London, the Londoners would be very happy if Mr. Allen's hopes were fully realized, as it would give them a greater chance of selling their own coke.

The report was adopted.

THE PAPERS READ.

Two papers were then read and discussed; and they will be found, with reports of the discussions, on the pages given after the titles in parentheses. The first was by Mr. H. W. WOODALL, of Bournemouth, on "Some Economies in Gas-Works" (p. 657); and the second was by Mr. R. P. HARRIS, of the Commercial Gas Company, entitled "Extraction of Tar and Water Vapour from Carburetted Water Gas" (p. 662).

SOCIETY OF BRITISH GAS INDUSTRIES.

THE Autumn General Meeting was held last Thursday, at the Trocadero Restaurant, Piccadilly Circus, W. The members were present in good numbers. During the opening proceedings, the CHAIRMAN of the Council (Mr. W. D. Helps) presided, pending the arrival of the PRESIDENT (Professor Harold B. Dixon, Ph.D., F.R.S.). The Chairman was supported by the Vice-Chairman (Mr. J. W. Broadhead).

LETTERS OF REGRET.

The SECRETARY (Mr. Arthur L. Griffith) read letters of regret from Sir Corbet Woodall, D.Sc., Mr. Dugald Clerk, F.R.S., D.Sc., and Mr. Thomas Newbigging, D.Sc.

THE NATIONAL GAS EXHIBITION.

The CHAIRMAN said, at this, the first meeting of the Society after the National Gas Exhibition, he should like to refer to the great success of the event in the opinion of the majority of the members. They had heard a good many people speak about what might have been. But he had never yet known anything of the kind to be carried through but what might have been improved. When they looked upon it from the various standpoints of what the exhibition really represented, he thought they might all, even those who were inclined to think that mistakes were made, and big mistakes in some directions, regard it from the real point of view of a centenary demonstration—to show to the public the great advancement that had been made in the use of gas. From that point of view, it was a grand success. Of those who had worked for the advancement during the hundred years, they might say: "Well done, good and faithful servants, you have made a great success of our industry during that hundred years."

Mr. F. J. WEST said he should like to endorse what the Chairman had said with regard to the exhibition. He thought they might congratulate themselves upon having achieved what they set out to do—that was, to arrange a co-operative exhibition, and a display for consumers. He did not suppose that at any exhibition it would be possible to satisfy everybody; but the Society, as a whole, had been quite satisfied with the share they took in it, and the members had nothing to regret. He wished to propose that their best thanks be tendered to those gentlemen who so ably served the Society on the Executive Committee. The real work was done by an Organizing Committee, upon which Mr. Helps, Mr. Yates, and Mr. Thornton (the Vice-Chairman of the Executive Committee) worked.

Mr. SAMUEL CUTLER, SEN., seconded the motion, which was unanimously carried.

The CHAIRMAN, on behalf of the members of the Executive Committee, acknowledged the vote.

BRITISH COMMERCIAL GAS ASSOCIATION.

The CHAIRMAN, referring to this subject, said the total subscription from the Society to the British Commercial Gas Association to September 30 last was £2289, against £2115 for the previous year. He hoped that members who had not so far subscribed through the Society would do so. He, as Chairman, had been discussing this matter of the subscriptions of the Society with Mr. Goodenough and Mr. Thornton. Mr. Goodenough had large ideas with regard to the contributions of the Society. He was not alone in this; being backed up by the most active members of the Institution of Gas Engineers. Their view was that the Society ought to do more; and it was a matter of opinion as to how much the Society ought to do. It was the desire of the Institution of Gas Engineers and of the members of the British Commercial Gas Association that the Society should use its energy and try to raise their subscription during the next twelve months. The Council would like to see every individual member contributing.

FEDERATING THE ORGANIZATIONS.

The CHAIRMAN remarked that at the annual meeting of the British Commercial Gas Association, the question of the federation of the three principal organizations of the gas industry was mooted by the President of the Institution of Gas Engineers (Mr. Edward Allen, M.Inst.C.E.); and it was thought that the first step should be that representatives of the Institution, the British Commercial Association, and the Society should meet and discuss the policy of federation, freely, openly, and independently. There was federation and federation. Among other things, there was one point he should like to make perfectly clear; and it was that the idea of having a central building had been altogether shelved, because there was no money available for this purpose for the time being. With regard to the Commercial Association as well as themselves, the idea was to simply go forward and federate themselves in a simple way—merely link-up together without losing any of their individuality or power as a Society. It was proposed by the Council that seven representatives of the Council should attend the preliminary meetings for the purpose of discussing the question, without binding the Society in any way. Then the delegates would report to the Council, and the Council would, if there was any necessity, call a special meeting of the members of the Society. He asked that the action of the Council in this matter be approved.

There was some discussion on the point; and, in the result, the action of the Council was approved, on the understanding that in any event the matter should be referred to the members at a meeting before anything definite was done.

THE GOLF CUP.

The CHAIRMAN announced that the match to determine the holder of the golf cup presented by Mr. H. James Yates was played at Starbeck, near Harrogate; and the winner was Mr. Harry Coates. He had much pleasure in presenting the cup to Mr. Coates to hold for twelve months, together with a replica of it, to be retained by him permanently.

In the unavoidable absence of Mr. Coates, Mr. SMITH-REWSE was present to receive the cups; and he made a suitable acknowledgment in the name of the winner.

WATERWAYS TRAFFIC.

Moved by Mr. THOMAS GLOVER (London), and seconded by Mr. R. J. MILBOURNE, the following resolution was passed:

> That this Society, having in view the cheaper transit facilities due to canal development in Germany, France, and Belgium, the countries chiefly competing with our manufacturers in our own and foreign markets, the congested conditions of transit of heavy and bulky goods in this country, and the consequent hindrance to trade, urges the Government to take immediate action upon the report and recommendations of the Royal Commission on Canals appointed upon their advice, by introducing a Bill to give immediate effect to paragraph 973, sub-sections 1 and 2, of the report, which recommends the appointment of a Waterways Board, and the acquisition by the State of the four trunk or main canal routes (referred to as "The Cross Report," paragraph 485). The Waterways Board acting as the Controlling Authority to be toll-takers only, not carriers (Report, paragraph 815). That a copy of the foregoing resolution be forwarded to the Prime Minister, with a request to support any proceedings which may be taken in the

House to give effect to the resolution, and that the Secretary of the Waterways Association be advised.

The CHAIRMAN observed, in regard to the foregoing matter, that it seemed to have been taken up very strongly; and as large transmitters of goods, he thought it only right the members of the Society should support it.

MEMBERSHIP OF THE COUNCIL.

Mr. THOMAS GLOVER (London) introduced a brief discussion on this subject. He thought that there ought to better provision made for changes in the constitution of the Council, in order that new blood might be infused into the work at more frequent intervals, and by more direct selection on the part of the members. He was not in any way attacking the individual members of the Council, but only criticizing the principle and system.

The CHAIRMAN made a few remarks on the subject, and pointed out that of recent years there had been frequent changes in the constitution of the Council; and that for the continuity of policy it would not be altogether a good thing that the administration of the Society's affairs should be left without members experienced in the work. He promised that the Council would not lose sight of Mr. Glover's representations.

THE PRESIDENT'S RECENT HONOURS.

Professor Harold B. Dixon, the President, having arrived,

The CHAIRMAN said the members were pleased to see their worthy President with them, and to have the opportunity of congratulating him upon the honours conferred upon him by the Royal Society (*ante*, p. 595). It was a mere coincidence, but it was curious that every President of the Society had had some honour conferred upon him during his year of presidency or soon after. [Applause.]

The PRESIDENT thanked the Chairman most heartily for his kind words, and the members for their endorsement. It was a coincidence perhaps that the honour came to him just now; but it was a lucky coincidence. He should always be proud to remember that he got this honour from His Majesty and the Royal Society the year that he was President of the Society of British Gas Industries.

THE PRESIDENT-ELECT.

The CHAIRMAN remarked that the Council congratulated themselves and every member of the Society upon having secured the services as President from next March of Sir Alfred Keogh, K.C.B., LL.D., M.D., Rector of the Imperial College of Science and Technology. They were anxious to secure Sir Alfred for many reasons, one of which was to broaden the representation of their Presidents as much as possible.

THOUGHTS BY ONE WHO THINKS.

Under this title, the Chairman of Council (Mr. W. D. Helps) read the paper printed on p. 667 of this issue. It was followed by a discussion, which is reported in the columns succeeding the paper.

This concluded the business.

DINNER AND CONCERT.

Dinner was afterwards served—the President being in the chair. Only the loyal toast was honoured. Subsequently, there was an entertainment under the direction of the Hon. Secretary (Mr. Cyril G. Davis)—the artistes being Miss Mabel James, Miss Olive Fox, Mr. Clay Thomas, Mr. Edward Victor, and Mr. Fred Milner. During the evening, Mr. Helps proposed the health of Mr. Davis and of the Secretary (Mr. Arthur L. Griffith). He spoke of the great indebtedness of the members to Mr. Davis for his work in providing for their entertainment, and to Mr. Griffith for his indefatigable exertions.

Benzol in Germany.—According to a paragraph in the "Iron and Coal Trades Review," the German Union of Benzol Manufacturers, which is now encouraging the use of that spirit for the operation of the engines of motor-cars, states that upwards of 30 million gallons are now being annually produced in Germany—a quantity which will be considerably increased during the coming year. The Union comprises no less than 70 benzol-producing concerns, who have agreed to turn out for motor-car use a uniform quality of spirit, depôts for the sale of which are being established in all parts of Germany.

Suggested Utilization of Mine Gases.—In the course of a paper on "Firedamp in Mines and the Prevention of Explosions," read at a meeting of the Manchester Geological and Mining Society, Mr. John Harger, of Heidelberg, suggested that firedamp could be sucked in by an air-pump, compressed, and sent out of the pit in pipes, by which means they would change what had been regarded as a pure danger into a valuable asset. He said a certain mine in Yorkshire had given off 4 million cubic feet of gas in 24 hours—enough to illuminate a good sized town. If the firedamp were properly harnessed, and burnt under properly constructed boilers, large quantities of gas would be obtained which required no purification of a very chemical nature, and could be used to mix with the intake air to provide a reduced oxygen atmosphere. Thus the mine could be rendered absolutely explosion-proof and fire-proof, while the power for working it could be obtained more cheaply than at present.

SOME ECONOMIES ON A GAS-WORKS.

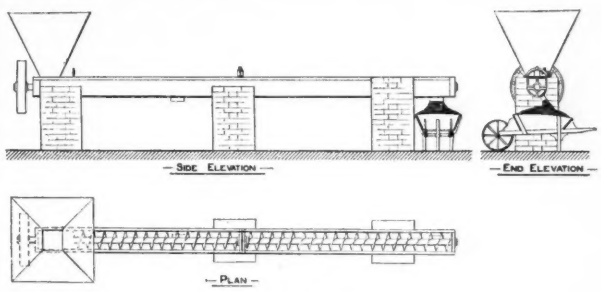
By HAROLD W. WOODALL, M.Inst.C.E., of Bournemouth.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 20.]

In submitting the accompanying notes, the author craves the indulgence of any engineers who may already be familiar with the apparatus described. He hopes that there may be others to whom the apparatus is novel, and to whom his brief paper may be of some slight service.

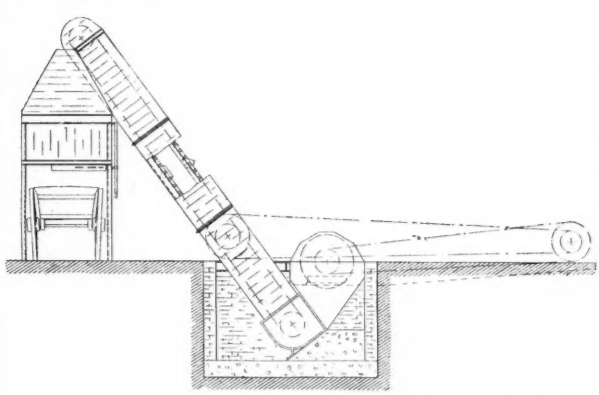
OXIDE PURIFICATION.

Few gas engineers—particularly those whose time is largely occupied in the office and district—can walk round their works without sometimes having an uncomfortable feeling that they do not know whether the time of some particular gang of men is as well employed as it might be. This has often struck the author in connection with oxide handling. The work, whether of spreading or mixing, is dull and monotonous, and in the case of the former, even after the oxide has been turned over, there is a great tendency (more particularly since most engineers work their boxes on the rotation system, and keep the oxide in for months at a time) to leave the oxide in small lumps and nodules, which never properly revivify in the centre.



Oxide Mixer.

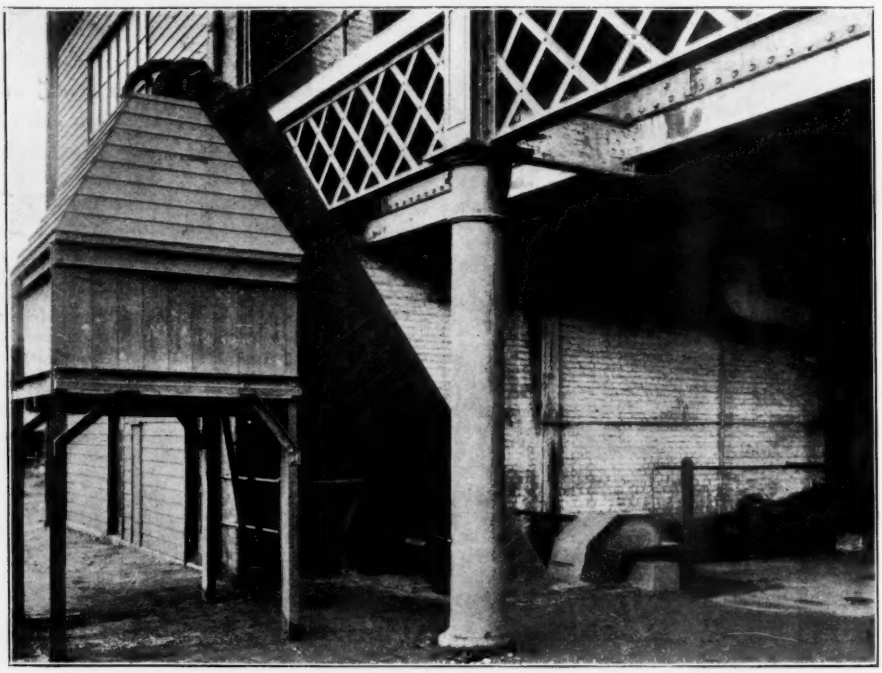
About ten years ago, the author introduced the use of a horse-drawn plough for oxide turning; and this answered its purpose very well for a while. Nowadays, however, the oxide is got out of the boxes with pickaxes as a rule, and must be laboriously broken before it is fit for spreading. About a year ago, an advertisement was received from Messrs. Carter and Co., of Dunstable, calling attention to their oxide breakers, and giving the name of the South Metropolitan Gas Company as using them. Through the courtesy of the Chairman of the latter Company—Mr. Charles Carpenter—a representative was given facilities to inspect the plant at their works; and as a result of the inspection the plant was introduced at Bournemouth.



Oxide Disintegrator and Elevator.

The plant is a very simple one, consisting of two circular iron cages rotating in opposite directions, the diameter of the outer being 3 feet. The oxide is wheeled to the disintegrator and pitched into a shoot at the ground level, which discharges into the centre of the inner cage. From here it has to pass first through the inner cage running in one direction, and thence through the outer cage rotating in the opposite direction. A little care has to be exercised in order to arrive at exactly the proper speed; but this is a simple matter. At Bournemouth, it is run at about 100 revolutions per minute.

The result is a beautifully graded oxide which is practically ready to go back into the boxes within twenty-four hours. The reason for this is that not only are all (even the smallest) lumps broken up into a coarse powder, which enables every particle to be exposed to the air, but the whole mass of oxide is brought into contact with the air, and subjected to a degree of oxidation that could



THE OXIDE AND SAWDUST MIXER AT THE BOURNEMOUTH GAS-WORKS.

never be obtained with the old methods of turning either with a shovel or a plough.

The cost of the installation at Bournemouth was as follows:

	£	s.	d.
Disintegrator	73	0	0
Foundations and fixing	10	0	0
Elevator and hopper	34	0	0
	£117	0	0

The cost of oxide handling, including breaking and turning, used to work out at 4s. 1½d. per ton. Under the new method it costs only 1s. 3d. per ton, and the work is much more efficiently performed.

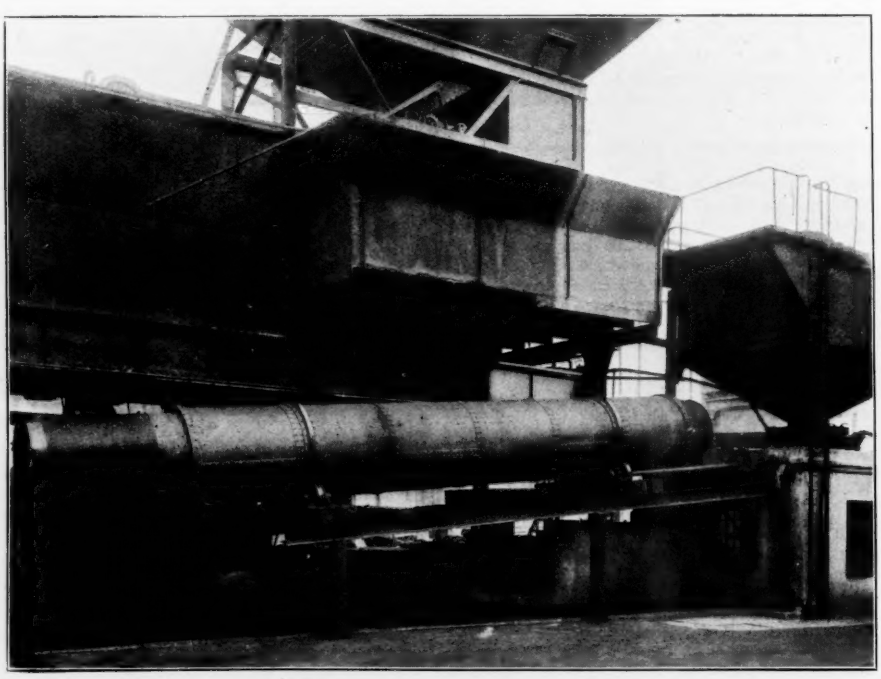
Having got over the oxide breaking trouble, the remaining difficulty was the oxide mixing. The Company used to buy Albion precipitated oxide, and now buy a similar rich oxide (containing upwards of 75 per cent. of hydrated ferric oxide) and mix it with locally purchased sawdust. Until recently the oxide used to be mixed as follows. Three measures of sawdust were spread in a small circle, two measures of oxide were then spread over the inner side of the sawdust, water was added as required, and the mixture was turned over into a heap, which was then ready for the purifier.

The author recently decided to try another method of mixing. On one of the works was an old worm-conveyor and trough. An 18 feet length of this was taken, a small hopper was constructed at one end, and water laid on with a controlling tap. Oxide and sawdust are wheeled in gauged quantities into the hopper, the tap is set to deliver just the quantity of water required, and the conveyor does the rest, delivering a perfectly mixed oxide at the discharging end. The mixer in question will deliver 3 tons of mixed oxide per hour. As mentioned, the conveyor and trough were already on the works, and all that had to be made was a small hopper; so that the cost of erection was practically *nil*. Under any circumstances the cost of new apparatus would be very small.

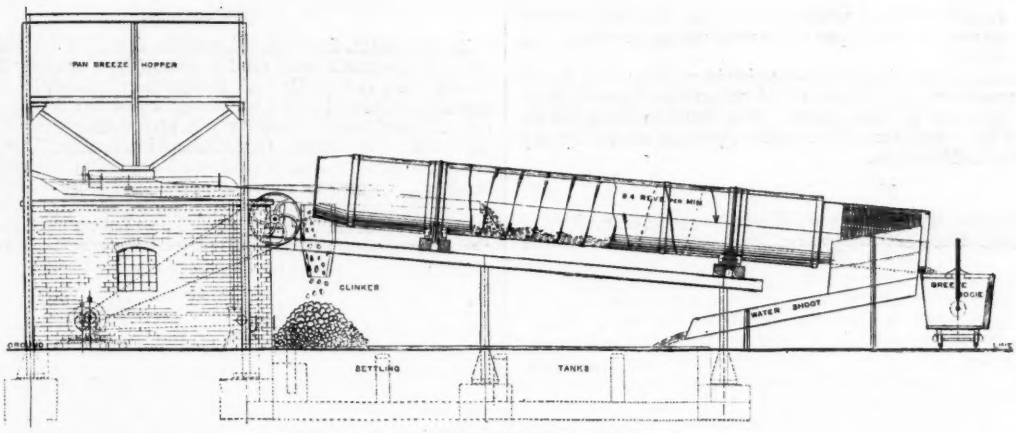
The cost of oxide mixing used to work out, including all charges for carting from the heap, &c., at 2s. 11d. per ton. With the new arrangement the cost, including all charges, works out at 6d. per ton.

Pan Breeze.

The handling of pan breeze has always been a rather troublesome business. Men do not like the work, and will not stop at it if they can help it. The Bournemouth Company used to pay a piecework price of 2s. 6d. per ton of recovered coke; but there was constant



THE BREEZE WASHING PLANT AT THE BOURNEMOUTH GAS-WORKS.



PAN BREEZE WASHING PLANT.

trouble from clinker being left in the coke, and even at that the men complained that they could not earn a living wage. Eventually it was decided to go back to ordinary time work, when the quality of the picked coke certainly improved; but the cost went up to 4s. 8d. per ton of recovered coke. The space available on the Poole Gas-Works is very limited, and the only yard for breeze picking is about 72 ft. by 48 ft. From six to eight old men and boys were kept constantly at work; but as each man's heap of recovered coke had to be kept separate, pan breeze had frequently to be carted to another works half-a-mile away, because there was no room to stack it on the gas-works.

The author was aware that Mr. Broadberry, of Tottenham, had experimented with a rotary breeze washer; but on communicating with him it was found that he was not doing anything further with his own washer. On the advice of Mr. Broadberry, however, the author communicated with Messrs. Coulson, of Spennymoor, and subsequently, through the courtesy of the Commercial Gas Company, inspected a washer in operation on their Poplar works, with the result that a rotary washer and supporting rollers, with circulating pump, were purchased from Messrs. Coulson. The supporting framework, hoppers, settling tank, &c., were provided and fixed by the Gas Company.

The plant consists, primarily, of a circular rotating drum, 4 feet in diameter and 35 ft. 4 in. in length. The first 30 ft. 4 in. is made of solid plate, inside which is a 2½-inch by ¼-inch flat bar fixed helically by means of angle-iron cleats, so that anything lodging against it must ultimately be discharged at the top end of the drum. The last 5 feet is made of perforated plate, also fitted with an internal helix, made of 2-inch by ¼-inch flat iron, so arranged that anything lodging against it is discharged at the lower end of the screen. Under the drum are settling bays; and a centrifugal pump circulates the water from these bays through the rotating drum. The method of operation is as follows.

The pan breeze is loaded into waggons in front of the producer which run on rails to a coke-crane. Here they are picked up, and the breeze is tipped on to a bar screen above the hopper at the top end of the rotating drum. This screen removes the largest pieces of clinker. To the bottom of the hopper is attached a wrought-iron shoot, extending into the upper end of the rotating drum into which the centrifugal pump discharges through two 2-inch pipes. The strong flow of water washes the pan breeze from the hopper down the shoot into the rotating drum. The clinker being heavier than the water sinks to the bottom, and is ultimately discharged at the upper end of the drum by the angle-iron helix. The coke being lighter than water is washed to the lower end of the rotating drum and discharged into skips, and subsequently tipped into the overhead coke-hoppers ready for loading into carts. The circulating water and fine breeze pass through the perforated lower portion of the drum into the settling bays, where the breeze is deposited, and the water recirculates by means of the centrifugal pump. The appearance of the coke is improved by being sprayed with clean water in the last few feet of the drum.

When the plant was first put to work, some difficulty was experienced owing to large coke being discharged at the upper end of the shoot with the clinker. At this time the breeze was being elevated and washed as it came from the producers, and was frequently red-hot. The first action when the red-hot coke came in contact with the carrying water was to generate steam. This subsequently condensed and formed a vacuum in the interstices of the coke, which were promptly filled by water, making the coke practically as heavy as clinker. This trouble was got over by allowing the pan breeze to cool a little before washing it.

The cost of the plant was as follows:—

	£	s.	d.
Rotating drum, rollers, drive, and pump	225	0	0
Motors, belts, &c.	58	5	0
House and settling pits	31	10	0
Supporting framework, hoppers, erection, and incidentals	195	12	0
	£510	7	0

One lad looks after the whole plant. Washing starts about 6.30 a.m., and is usually finished by midday, and the yard swept up and cleaned. The rest of the lad's time is devoted to cleaning

THE BOURNEMOUTH GAS AND WATER COMPANY'S FLEET OF MOTORS.

the plant, cleaning out the settling tanks, &c. The total cost of washing works out at 1s. 6d. per ton, as against 2s. 6d. and 4s. 8d. per ton previously.

The recovered coke is greatly superior in quality; and we are obtaining 1000 tons per annum, as against 640 tons formerly from the same quantity of pan breeze. The freedom from labour trouble and the cleanliness of the washing process are not by any means its least attractions.

Motor Haulage.

The author has considerable diffidence in complying with the request of the President for particulars as to the cost of motor haulage at Bournemouth; for while the motors adopted have justified the anticipations with which they were introduced, the petrol vans were purchased in 1906, and are not, therefore, comparable with the vehicles now being put upon the road. At the same time, it may be pointed out that the figures quoted are the total charges on motors that have been on the road for a considerable period, and are possibly more reliable than figures which may be obtained by new vehicles running on full load over selected journeys. The figures are abstracted direct from the Company's motor registers.

Milne's Daimler 30 Cwt. Petrol Van No. 1.

Driver's wages, 6½d. per hour; assistant, 6d. per hour.
Ton-miles in half year to June 30, 1913, 4395.
Cost per ton-mile—

Labour	4·27d.
Petrol	1·52
Stores	0·32
Total	6·11d.

Milne's Daimler Petrol Van No. 2.

Driver's wages, 6½d. per hour; assistant, 6d. per hour.
Ton-miles run in half year to June 30, 1913, 4494.
Cost per ton-mile—

Labour	4·27d.
Petrol	1·50d.
Stores	0·53d.
Total	6·30d.

Foden Steam-Waggon No. 1.

Carrying 5 tons on body and drawing 3 tons.

Driver's wages, 6½d. per hour; assistant, 6d. per hour.
Ton-miles run during half year to June 30, 1913, 7490.
Cost per ton-mile—

Labour	2·36d.
Fuel	0·74d.
Stores	0·07d.
Total	3·17d.

Foden Steam-Waggon No. 2.

Carrying 5 tons on body and drawing 3 tons.

Driver's wages, 6½d. per hour; assistant, 6d. per hour.
Ton-miles run during half year to June 30, 1913, 10,827.
Cost per ton-mile—

Labour	1·72d.
Fuel	0·55d.
Stores	0·06d.
Total	2·33d.

Wallis and Steevens Steam Tractor.

Drawing maximum load of 6 tons.

Driver's wages, 6½d. per hour; assistant, 6d. per hour.
Ton-miles run during half year to June 30, 1913, 9619.
Cost per ton-mile—

Labour	1·98d.
Fuel	0·66d.
Stores	0·13d.
Total	2 77d.

The general conclusion of the author with regard to motor traction is that where weight is not of great importance, it pays best to use steam-waggons, which, of course, have the additional advantage of using a gas-works bye-product for the generation of power.

For delivering coke to private houses, and in some cases to laundries, the five-ton Foden waggons are too big, and damage the surface of the entrances, and, in some cases, the surface water drains also. A new class of Foden waggon is now being built, fitted with india-rubber tyres, carrying 3 tons. Two of these are being used in Dorset on very bad roads, and the drivers tell me that they are giving complete satisfaction.

Where it is required to carry large quantities of coke in bulk, the author believes that it pays best to use traction-engines. Where local conditions call for the use of light motors and internal combustion engines, the author would prefer to keep them as large as possible, with a carrying capacity of 2 to 3 tons, and ample horse power.

The makers of the "Commer" car are now fitting the Southey carburettor which they claim enables them to use paraffin at 7d. a gallon, in place of petrol at 1s. 4d., with equally satisfactory results per gallon.

DISCUSSION.

Mr. Woodall drew attention to the fact that the makers of the oxide disintegrator were unable to supply diagrams which would clearly show the working of the machine; but they had forwarded an excellent model which was exhibited in the room. As to the cost of the plant for handling pan breeze, the item of "Supporting framework, hoppers, erection, and incidentals, £195 12s.," was really higher than it ought to have been, owing to the fact that at the last moment they were compelled to alter their arrangements, and put the apparatus in a different place from that first decided upon. He calculated that this had entailed an outlay of at least £50 more than would otherwise have been spent. He would also like to say that he did not put forward the figures in regard to petrol vans as being in any way comparative with what could be done. He gave them because the President wished for some information with reference to motor traction; and he hoped that the result of what he had said would be to elicit reliable details from other members.

The President (Mr. H. O. Carr, of Wandsworth) said he felt sure the paper would give rise to a good discussion. Mr. Goulden had kindly promised to make a few remarks; and he would ask him to open the discussion.

Mr. Thomas Goulden (London) said that when Mr. Price, a short time ago, wrote and asked him whether he could give a few points with regard to motor traction, he felt that he would be glad to be able to place at the service of the Association any facts he had. But he had not till that afternoon had the paper in his possession, so that he was not very well able to put any figures forward—except perhaps a few averages—which would make comparison with those that had been quoted in the paper. In fact, he was not prepared to discuss the paper, much less to criticize it. He would far rather congratulate the Southern District Association on Mr. Woodall having sufficient time and inclination to devote his energies to the solving of these small problems which lay before all of those who were engaged in gas-works, in the same successful manner as he had already done in connection with the more important matter of carbonization. The whole gas industry was under a debt of obligation to him for his work on carbonization; and it did not need, really, for him to add these smaller services, which they were at the same time very glad to have. He was pleased to be at the meeting that day, because he had gathered some very useful tips from Mr. Woodall's description of the oxide disintegrator, and the simple method he adopted to deal efficiently with the preparation of oxide; and he was glad to acknowledge his indebtedness for information of which he would certainly take early advantage. As to the handling of pan breeze, it was gratifying to see that the author was getting such excellent results from the Blackett washer made by Messrs. Coulson. It was a long time since he first saw it at the Tottenham Gas-Works—or, rather, it was not the Blackett there, but a small washer similar in principle which Mr. Broadberry had been using, without knowledge that the Blackett washer had been employed for coal washing in the North. His (Mr. Goulden's) Company had adopted it very extensively, and were getting excellent results. They were all aware that the disposal of pan breeze was a very difficult matter indeed; and in London it was specially hard to get rid of. But the Blackett washer was solving the problem; and they were not only dealing with all the material they made, but were in addition clearing away large heaps which had been occupying valuable space on the works. The working of the Blackett washer in their case was such that they were giving added value to the original material that they were treating. That was to say, taking into account all waste—small clinker, &c. —they were increasing the original value four-fold. This was a very considerable economy, though relatively it was but a small matter. With reference to motor traction, he was almost sorry to see that the greater economy rested with steam waggons. Of course, they knew that it must be so, because steam waggons were capable of dealing with larger loads. But though they might be applicable to the country, where they did not have to run through long streets (the inhabitants in which were certainly very much incommoded by the passage of these waggons), for use in London he must say he preferred a motor-waggon that ran on tyres. The Company were getting very fair economy with motors which carried some 3 tons about the streets. Round the docks they could use steam traction, and could attach a trailer if they liked, without anyone complaining; but at the end of the town in which they were now assembled, he would object rather to a steam tractor, with its tremendous vibration and noise, and the amount of room that it monopolized. His Company found—probably owing to the absence of hills, of which there were many in Mr. Woodall's district—that they were able to do their work somewhat cheaper with their petrol vans. Possibly they had more employment for their vans; and they were able to increase the ton-mileage per six months from the less than 5000 mentioned in the paper, to something like 10,000. Of course, this made for economy; and they found that, as an average, instead of the total cost for labour, petrol, and stores being 6·11d. per ton-mile as in the case of Bournemouth, they were able to work at something under 4d. It must always be remembered that they had better gradients and better roads, and probably they had a larger load-factor per waggon. There was a driver and an assistant, to whom they paid current rates of wages, which came to 2d. or 3d. per ton-mile; while the charge for petrol (for which the Company had an advantageous contract, under which it was only costing them 1s. per gallon) was from 0·8d. to 1d. per mile. He rather fancied the

author could not have included tyres. Taking tyres into account, which amounted in their own case to something like ¾d. per mile, the cost would come in well under 1d. These motors were very convenient, and worked very well. They had tried various sizes, but found, with the numerous stoppages and calls, that a 3-ton motor was about the best size they could apply to their work. He thanked Mr. Woodall for the information contained in the paper, which constituted a valuable addition to their records.

Mr. W. Doig Gibb (London) remarked that, in common with all the audience, he could say that he had listened to a highly interesting and instructive paper. He would not spend any of the little time that might be allowed him on saying anything about the washing plant, beyond stating that he had seen it, and it worked exceedingly well. Another section of the paper he could dismiss by congratulating the author on having found a cheap and efficient oxide mixer—and congratulate him, perhaps, still further because he must have had an exceedingly bad conveyor. [Laughter.] But coming to the third subject of the paper, he said at once that there was nothing more difficult than to give figures which would be at all comparable. First of all, the trouble came in of what was included in the figure that was quoted. In his own case, he found that, counting everything right down to the spare parts carried for each car, and including the time spent in the sheds for overhauling, and every conceivable charge that could fairly be made, with a 3-ton petrol waggon, according to the work, the cost came out at from 3½d. to 6½d. per ton-mile. The latter amount represented perhaps the worst possible figure for a modern car doing the most expensive work. He was inclined to a certain extent to quarrel with the ton-mile as being a proper comparison; and he only accepted it because of the want of a better one. They would, he was sure, all immediately recognize that, as long as one carried such opposite goods as lamp-shades down to iron stoves, the possible tonnage that might be carried on the motor might be a varying amount. A car might run 10 or 12 miles carrying a mere fraction of its load; and the same car loaded up with about 4 tons, multiplied by mileage, would give a very good figure indeed. Yet there was nothing like this amount of difference in the cost of running light and running heavy. Other systems of comparison were equally faulty. The price per day, for example, was. He would say that their standard car was a three-tonner. He was thoroughly in agreement with the remarks made as to the use of Foden steam-waggons and petrol-driven cars. For all-round general purposes, perhaps, the best was a 3-ton petrol waggon. Again, when making these comparisons, he only wished he could put into his calculations figures such as 6½d. and 6d. per hour for driver and assistant. This, of course, depended upon local conditions. His own Company paid a driver 10d. per hour, or 40s. for a 48-hour week, and an assistant 35s. per week. Both were skilled drivers; so that if any accident happened to the chief man the second man was able to take the car home. His Chairman realized that driving these heavy motors in the London streets was a nerve-breaking ordeal; and they had instituted a 48-hour week for the men. It did not pay to leave expensive machinery standing stationary. If a great deal of money was expended on it, they could only hope to make it pay by using it as much as possible. Therefore the question arose, How were they to arrange things to give drivers a 48-hour week and at the same time keep the motors on the road longer? Well, they gave all the men one working day in the week off, with pay. That was to say, they worked a little longer on the five days they did work than an ordinary 48-hour a week yard labourer; but at the end of the week the hours came to 48. He did think, with the conditions of London traffic, it was necessary that men driving motors all their time should have some such consideration, rather than that they should perhaps be forced to steady their nerves by means of drugs. He had already said that their costs ran from 3½d. to 6½d. per mile; and the question might be asked how these motors compared with horse traction. Motors must be employed to full advantage, or they were of no use. But they found very varying results, according to weights and distances. With 3 to 4 ton waggons, they reckoned they displaced three to six horses, according to the work done. Even allowing very heavy depreciation, by which the first cost of each car was wiped off in seven years, they found they were doing cheaper work with motors than with horses; and there was the great indirect advantage that they were serving their consumers better—giving more prompt attention—a matter which, though it could not be put into shillings and pence per motor, had to be considered. Then seven years was not the time they could reckon as finishing a car. His Company first started cars in 1904, and their entire cost had been written-off in the time named. Yet these cars were still going as strong as ever. Possibly they were a little more expensive than modern cars; but they were doing very good work. Perhaps at some future time further information which he could give them might be made public. There was one point he might refer to which was very interesting. In 1904, they thought a three-tonner was quite well equipped with 12-horse power. Then when the next lot came along two years later, they thought 16 and 22 horse power good enough. When the last lot of six was purchased a year ago, they found it best to have 32-horse power. He thought Mr. Woodall had forgetten a very important point as regarded motors in the economy of gas-works, and that was a passenger car for the engineer. It seemed to him (the speaker) that in many works the directors were very short-sighted to pay the engineer a good salary for the size of the place—pay him for his brains and the supervision he could give to the business—and still, for the sake of saving the cost of a motor-car, make him tram it or walk it. In this way, for the money they paid him as salary, they were getting infinitely less of his brain power and supervisory power than they would do if they provided him with some more rapid means of proceeding from one place to another.

Mr. Thomas Glover (Norwich) joined in thanks to Mr. Woodall for his paper, which, he said, was just the sort they needed for their District Associations. He had followed with great interest the description of the oxide disintegrator. He had seen it at work at artificial manure factories, breaking up material which was more refractory than oxide; and he had been considering the question of putting one down in connection with his oxide elevator, for treating the nodules and lumps of oxide referred to. The oxide in his boxes came out very hard. It was in for months, and in one deep layer about 4 feet thick; and it had to be moved with very great labour with pickaxes. He quite appreciated what had been said about the work being dull and monotonous, and very difficult to supervise; and no doubt they often paid heavily for breaking-up and turning oxide, which might be done very much better with the machine in question. He took it that the wear and tear was not very high—that the oxide did not affect the bars or the machinery, or that no great amount of dust was produced; and he thought the author said that after passing through the disintegrator and being handled, the oxide was almost ready for use again—oxide practically newly out of the boxes. [Mr. Woodall: Yes.] This must mean a great saving of room, and would carry with it other substantial advantages. To take up the oxide almost straight out of the boxes, and put it through the disintegrator, and move it to where one wanted it next, must be a large benefit. With reference to the ash washer, he had seen this at work by the courtesy of Mr. Goulden; and it was doing very well. It was used in Durham for treating slack coal; and he was very much smitten with it. In fact, he was sorry that he had not been able to find a place for one, as he believed it was just the thing for treating furnace ashes. He had also followed with great interest the discussion with reference to motors. A lot depended upon the distances hauled and the weight carried. In his own case, they had a 4-ton steam waggon and a 30-cwt. petrol waggon, as well as many horses and waggons. One thing he had noticed all the speakers seemed to have left out—the interest on capital and depreciation, in working out the costs. In the case, he thought, of these waggons, the first cost was something over £500; so that it was a figure which could not well be ignored. With regard to which it should be—a petrol-driven or stream-driven waggon, some were in favour of petrol, because, he supposed, of neatness; but it must be remembered that, in the case of the steam waggon, the fuel that was used might come from their own works, and be an advertisement to other people. Broken coke was an excellent fuel, if the waggon was provided with a sufficiently large fire-box. In the case of the Foden waggon, they specifically mentioned that it was able to burn coke as well as coal. Some others, of course, left out coke, and said the waggons worked best with Welsh steam coal. As gas men, however, they wanted to encourage the other material; and he thought that in choosing his next waggon he would be favourable to the 3-ton steam type—now that this could be had with rubber tyres, and could move at 12 to 15 miles an hour without noise or vibration. Several firms were producing very good ones indeed. The 30-cwt. petrol waggon was most convenient for quick delivery about town, and within a range of 4 or 5, or even more, miles. But on comparing the cost of delivering by steam waggon with that by petrol waggon, for a distance of 11 miles, it came to 2s. 4·52d. per ton for the steam waggon and 5s. 6·10d. per ton for the petrol waggon. This was equal to 2·5d. per mile for the steam waggon, and 6·01d. for the petrol waggon. This was taking a definite 11-mile journey. It used to cost them 8s. a ton for delivery by horses and waggon, or 8·73d. per ton-mile; so they would see that there was a very great advantage in favour of motor haulage for taking out coke to country customers, with regard to cost, as well as to quickness of delivery and so forth. In fact, everything was favourable to motor haulage; and there were better waggons to be had now than was the case a few years ago. The 30-cwt. petrol waggon was of 30-horse power, he believed. It moved very quickly. There was one other point. In the case of the petrol waggon, the mechanism was of the petrol motor type—he meant to say it was "finnicky." In the case of the steam waggon, on the other hand, it was an engine fitter's job to put it in thorough repair. With the petrol waggon, they could not be expected to keep spare parts and be ready for every eventuality when a breakdown occurred; but with the steam waggon, it was simply an ordinary mechanic's job to put it right.

The President congratulated Mr. Woodall on his paper, and endorsed all that had been said by the author with regard to the disintegrator. They had had one, he said, at Wandsworth for some time; and it seemed an excellent solution of trouble from hard, lumpy masses of oxide coming out of the purifier. It was quite easy to grade the oxide, according to the speed at which the disintegrator was run, and at the same time to give it enough moisture and to re-alkalize the material before it went back into the purifier. In his case it was laid along the cellars, and was merely once turned over before it was put into the purifier again, to make quite sure that it was well aërated. What had been exceedingly attractive to him in the paper was the question of traction by steam waggons. The problem presented itself, between the Wandsworth and the Mitcham works, as to whether it was expedient to make a great deal more gas at Wandsworth and make

less at Mitcham. At the time it was a matter of a difference of some 4s. per ton of coal between the two, because in the case of Wandsworth they had their own steamers, which sailed from the North and came right up the Thames, which was a very economical way of getting coal. For the Mitcham works, on the other hand, the coal had to be shipped into the Thames, and then transferred to barges, and from the barges to the railway, and from the railway to carts which went to the works. Therefore it seemed to them there was a problem which they should endeavour to solve; and the suggestion was made, and adopted, that they should try a steam waggon. They had a trial for a little while; and it appeared to them that it was going to be a very good thing indeed. In this case, they were working under ideal conditions—nearly the most perfect conditions one could think of for conveying coal from one part to another. That was to say, the coal was handled by conveyors in the first instance, and practically dropped by the conveyors into these steam waggons, which held, on an average, with the trailer, about 10 tons. Then, once it was in motion, it was very soon on the main road, which was generally either granite or wood laid. There was only one small gradient over a railway. Otherwise the road was practically flat; so that there were first-class conditions for running. They now had four of these steam waggons; and they found, on getting out the figures for the last six weeks, that the cost between the two works—that was to say, from the time the waggons and trailers were loaded to the time they were opposite the unloading place at Mitcham—came out at 6¼d. for 5 miles. Put in another way, this was a matter of 1¼d. per ton-mile. This figure, he would here like to say, did include 10 per cent. depreciation, and renewals at 10 per cent. It also provided for insurance, labour, and stores. Each steam waggon made five journeys per day—thus travelling 50 miles per day. It was quite evident that, with the aid of the steam waggons, the problem of keeping the Mitcham works open was solved; and it was a happy day for the men at Mitcham when the first steam waggon arrived. Others had been ordered in succession, until now the fourth had come to hand. Unlike the other three, however, which were of the English manufactured type, the last one had been made in France; and it would carry a load of more than 10 tons quite easily over the bridge on the road. Comparatively speaking, it was, perhaps, not so robust as the British-made machine; but he could not say that it was delicate. It did use coke most effectively, and was more powerful.

Mr. A. E. Broadberry (Tottenham) remarked that he was not going to make a long speech, but wished to touch on a few points. He would have liked to have said a word or two about the disintegrator and the washer; but time was flying, and he thought the interest chiefly centred on the cartage of coke and other materials by motors. His Company had since 1909 employed petrol lorries, carrying some of them 3 tons and some 3½ tons; and taking the costs out on the lines which Mr. Woodall had adopted, he found that his own figures came out considerably less than the author's—no doubt owing to the facts that the Tottenham district was very flat, and the cars carried 3 and 3½ tons, as against Mr. Woodall's 30 cwt. The cost of the driver and his assistant in the case of the 30-cwt. car was, of course, quite as high as for the driver and his assistant for a car carrying twice the quantity; and thus the charge per ton for the latter was halved. He had some particulars of costs with him. For one of the 3½-ton cars the figure was 2·87d. per ton-mile, and for another 3·08d. For a 3-ton car the figure was 3·33d. per ton-mile, and for another 3·05d. The steam lorry they were using, which carried, including its trailer, 7 tons, came out at 2·95d. per ton-mile. They found, however, that a heavy steam waggon could not be used in very many places. The roads must be particularly good and hard, and the entrances very solid and strong, to enable them to employ a steamer; whereas the petrol waggon could go practically anywhere. One point he thought perhaps might be of interest was that, in paying their drivers, his Company not only paid them a standing wage, but they gave the men a commission of 1d. per ton for all weight carried and ¼d. per mile for every mile run. The effect of this was that a driver never complained that he was being sent out rather late in the afternoon, because he knew that he was going to get so much more tonnage and mileage; and he did not much mind whether he was having short journeys with a heavy load, or long journeys with a light load. In his opinion, some such plan probably made a great deal of difference between success and failure in a system of this description. If the men had an interest in the weight they carried and the miles they ran, in addition to their ordinary standing wage, it just made all the difference in their willingness in doing the work.

The President said he wished to supplement his remarks by saying, with regard to the waggons he had referred to, that they made five journeys a day—5 miles there and 5 miles back. It was thus a matter of 50 miles a day.

Mr. Doig Gibb remarked that he would just like to add that his Company's commercial cars ran on benzol; and they found that they obtained, comparatively speaking, about 20 per cent. more power per gallon out of benzol than formerly from petrol.

The President said he would like to add, further, that the men were paid a tonnage rate, which satisfied them very well.

Mr. Woodall, in replying on the discussion, acknowledged his indebtedness to the various speakers for the kind and courteous things they had said with regard to his humble and not very worthy paper. He remarked that he would emphasize the fact that the paper was not a record of personal work, but merely a record of the advantage his Company had taken of the work of other people. One was only too happy to pass on information which had been of value to one's self and one's Company. He accepted everything Mr. Goulden had said with regard to motor traction. Of course, steam traction was a troublesome thing to pass through the streets of a city; and for this purpose such motors were most unsuitable. He thought, however, that when they used rubber-tyred steam waggons, they were pretty nearly as quiet as petrol waggons, and certainly quieter than many of the omnibuses on the road at the present time. In giving the cost of the Milne-Daimlers, he had told them that he was dealing with a very old car; and Mr. Doig Gibb had pointed out the weakest thing about them, when he said that some years ago his Company were satisfied with 12-horse power, and that now they wanted 32 horse power. His (Mr. Woodall's) own cars were 9-horse power, in a hilly district; so it could be imagined that they were rather crippled. In addition, they were only carrying 30 cwt. But even with all this, he agreed with Mr. Glover that the steam waggon, where they could use it suitably, was consuming a product of their own works, and to this extent was very valuable. They had tried benzol on the Milne-Daimler machines; but the carburettors would not take it. With regard to paying men, he congratulated Mr. Doig Gibb and his Company on the lead they were giving others by the splendid way they treated their men. The people employed by his own Company were happy and contented; and they were moderately well paid. Mr. Doig Gibb had pointed out that his men were exposed to trials and difficulties from which those engaged with the Bournemouth Company were free. Driving at a rapid rate through London streets must be nerve-racking, and it was a very kindly Company that secured to their men such payment as enabled them to work short hours and get a good return at the end of the week, and so preserve their nerves. The Company themselves must profit by this, because good employees were not easy to replace. Mr. Glover had made a remark, when dealing with the disintegrator, about putting the oxide back. If they looked at the model in the room, they would see that there was a tremendous swirling action, which gave very intimate contact of all oxide with the air; and as a result they had at the expiration of the few minutes it took to pass through the machine what they could not do in days with the ordinary process. It paid, of course, to leave it; but they had taken oxide out and passed it through the disintegrator, and put it straight back again, and it had worked well.

Mr. Glover: What horse power is required in order to drive the machine?

Mr. Woodall: It is driven off the shaft which is driving a Walker scrubber, so that it cannot be taking very much—say, about 5-horse power. Continuing, he said that Mr. Broadberry's commission system must be a great encouragement to the men. In his own case, they paid a handsome commission to all the employees who ran beyond a certain mileage.

On the proposition of the President, Mr. Woodall was thanked for his paper.

EXTRACTION OF TAR FROM WATER GAS.

By R. P. Harris, of the Commercial Gas Company, Stepney.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 20.]

It occurred to me, on my being asked by your President to supply a paper for the autumn meeting of the Association, that the extraction of tar from carburetted water gas was a subject on which I might be able perhaps to give some interesting particulars, and be the means of promoting a valuable discussion.

As we know, of late the high price of gas oil has somewhat discouraged the production of carburetted water gas. The present state of the coke market alone is a factor which causes us to look around for some further means to, if possible, reduce the cost of manufacture, thereby retaining our largest consumer for coke. Digressing for the moment, the following figures (which are taken from the Board of Trade returns for 1910) may be sufficient excuse for my so doing:—

Coal carbonized in the United Kingdom during 1910 .	15,397,783 tons.
Coke made for sale (taken at 10 cwt.)	7,698,891 ,,
Of that carburetted water gas absorbed about . . .	439,803 ,,
The balance of coke for actual sale being	7,259,088 ,,

Supposing that all coal gas had been made—1 ton of coal being taken to produce 11,380 cubic feet—this would bring the coal up to 17,458,957 tons, and yield 8,729,478 tons of coke. Thus the manufacture of water gas has relieved the market to the extent of 1,470,390 tons of coke. According to these figures, together with the present tendency to displace coke by other means of heating—such as gas and anthracite—any improvement that tends to the efficient working and the cheapening of water gas commends itself, I think, very strongly.

On the elimination of tar from water gas depends the efficient working and long life of the purifiers, and, correspondingly, the lower cost of production. The satisfactory elimination of tar fog has not, up to the present, proved entirely successful. The need of a reliable test, whereby one can determine the exact amount of tar contained in a certain quantity of gas, has somewhat handicapped my efforts, from a comparative point of view, in making this subject more interesting. Various methods were tried, and

tests made; but the results obtained were most contradictory and misleading. The formation of tar fog is due probably to a too quick cooling-down of the hot gases after leaving the superheater, and between the washer and the scrubber; the temperature being reduced to the extent of no less than 1000° Fahr.—the action being that with the cooling-down taking place so rapidly, there is a sudden and instantaneous formation of tar fog, composed of minute particles of liquid, which are easily carried along in suspension by the gas. If the cooling could be brought about more gradually, it would no doubt help to solve one of the most difficult problems in connection with water gas manufacture.

Before going further, I should explain that it was my intention, at the commencement of the paper, to ascertain the approximate amount of tar made from each of the three plants; but, owing to certain difficulties, this was only possible in the case of one of the plants. Very special care was taken in the foregoing tests that the conditions should vary as little as possible; the experiments being made simultaneously, "so to speak," at each part of the installation. The various means adopted for extracting the tar, and the particulars given, are obtained from three different installations; and in order that they may be more easily followed, I propose taking each one in turn. All the plants are of the Humphreys and Glasgow type, working on the Lowe principle. The oil used was an American distillate of ·860 specific gravity; and the atmospheric temperature throughout the tests was about 64° Fahr.

No. 1 Water-Gas Plant.

(*Nominal Capacity*, 800,000 *Cubic Feet per Day*.)

The water-gas plant is of the usual standard pattern, composed of generator, carburettor, superheater, washer, scrubber, and condenser. The temperature of the gas on leaving the condenser is about 147° Fahr., which, it will be noticed, is very much higher on comparing with the temperatures on the other two plants. This is due to the water, after passing through the condenser, being again used as feed-water for the oil-gas boilers—the demand of the boilers regulating the supply of the condenser; the idea being to supply the boilers with warm water, the condenser thereby acting in a dual capacity of cooling the gas and heating the feed-water. On leaving the condenser, the gas passes through a short length of 20-inch diameter main to the relief holder; the temperature on the inlet being 118° Fahr. and on the outlet 98° Fahr. Thence the gas passes to the exhauster, and then through to the extractors, entering the A purifier at a temperature of about 89° Fahr. The relief holder gives a condensing surface of 6218 superficial feet, and the 20-inch diameter cast-iron main, which runs in the open, 2970 superficial feet; making between the plant to the tar extractor a total of 9188 superficial feet condensing capacity.

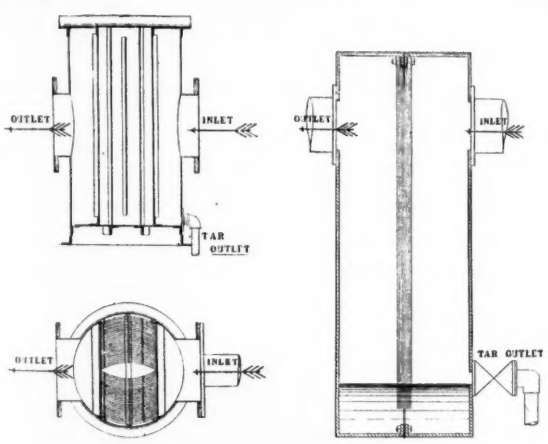


Fig. 1. Fig. 2.

Types of Tar Extractors.

It will be seen on comparing this plant with Nos. 2 and 3 that the condensing system is of a much smaller capacity to the gas made, and therefore probably more tar in the gas passing forward through the different apparatus. Situated about 80 feet from the purifiers, and in the open, is the tar-extractor (see fig. 1), consisting of a circular cast-iron vessel, 4 ft. 6 in. high by 2 ft. 4 in. diameter. The inside is composed of a nest of curved plates 3 feet in length and ⅜ inch apart; each plate having two rows of fins extending from top to bottom. The size of the inlet when first put to work was 12 inches; but this has since been reduced to 6 inches, in order to increase the velocity.

The action is as follows: The gas, entering the apparatus at an increased speed, travels in a circular direction round the curved plates, and in its journey through, the tar particles are impinged against the fins.

An automatic syphon is attached to the apparatus for taking away the tar and liquor. The extractor occupies a space of about 19 cubic feet, and produces 53 gallons of tar and 73 gallons of liquor in twenty-four hours; the gas made being 844,000 cubic feet, and the oil used 1894 gallons, or 63 gallons of tar per million cubic feet. Coupled direct to this extractor is another arrangement, consisting of a cast-iron box filled with small clinker, and of about 78 cubic feet capacity. This arrangement does not appear to be particularly efficient—only producing 13·7 gallons of tar per million cubic feet. On leaving the tar-extractors, the gas passes to the purifiers, which it enters at about 75° Fahr. The purifiers are 24 ft. by 24 ft. by 6 ft., and contain two tiers of oxide, 22 inches and 24 inches in depth. At the bottom is placed a tier of sawdust, 6 inches thick, to act as a filter. The method of using a layer of material in the bottom of each purifier which shall be close and yet non-porous has proved fairly satisfactory. In this particular case of sawdust, on a purifier becoming the first vessel very little back-pressure is thrown at the commencement; but there is no doubt, from various observations made, that the gradual "mounting up" is due to a large extent to the tier of sawdust becoming permeated with tar.

On a purifier being emptied just lately, several blow-holes were noticed in the tier of filtering material, showing that the gas had forced its way through the weakest places, or, in other words, "short circuited." On a sample of sawdust tested, it was found that a cubic foot of this tarry material contained 3½ lbs. of tar.

No. 2 Water-Gas Plant.

(*Nominal Capacity*, 1,200,000 *Cubic Feet per Day*)

No. 2 plant is similar to No. 1, except that its gas-producing capacity is greater. The gas on leaving the condenser, at a temperature of 95° Fahr., passes to the relief holder (the superficial area of which is 4543 feet), leaving it at 82° Fahr., and thence, through the exhauster, to two extractors, which are situated on the inlet to the purifiers. The length of the 20-inch diameter cast-iron main connecting the plant to the purifiers is 1800 feet, giving a superficial area of 10,131 feet; but instead of running in the open, as in Nos. 1 and 3 plants, this is carried below ground—the effect probably being to somewhat impair its condensing efficiency. On coming to the two tar-extractors (see fig. 2), which are worked in parallel, each apparatus consists of a 30-inch water-valve, rectangular in shape, with a semi-circular top, arranged inside; and extending from the top to within 6 inches of the bottom of the vessel are twelve $\frac{1}{16}$-inch thick perforated plates, ¼-inch apart, having 54 $\frac{1}{16}$-inch diameter holes to the square inch. The tar is drained off by means of an automatic syphon, the outlet of which is 12 inches from the bottom of the extractor. The arrangements of the connections are such that either extractor can be bye-passed.

The action of the apparatus is as follows: The gas enters through a 12-inch inlet, and is impinged against each perforated plate, the holes of which are arranged so as to "hit and miss;" the effect produced being of a wire-drawing nature. It is, however, necessary that the temperature should not be allowed to drop (say) below 70°; the percentage of water contained in the gas at this temperature helping to bring down the tar collected on each plate. From the time of first putting to work, the differential pressure rose to 6 inches, and has remained at this during the two years the extractors have been in operation. In the event of any blockage occurring, and the pressure increasing to 12 inches, the ends of the perforated plates become unsealed, and the gas passes by way of the 6-inch clearance left at the bottom of the extractor.

From observations taken at different times, it is apparent that the influence of velocity has a great deal to do with the efficiency of this particular method; more tar being taken out with one extractor working, and half the amount of gas passing, than with two. Or, in other words, the removal of tar fog in this apparatus to a large extent depends on the momentum given to the tarry particles by the speed at which they come in contact with the perforated plates. The tar-extractors occupy, neglecting connections, 126 cubic feet of space, and produce, on an average, 26 gallons of tar and 32 gallons of liquor; the gas passed being 1,370,000 cubic feet, and the oil used 2652 gallons. Previous to the use of perforated plates, clinkers of about 1-inch cube were tried; but although the results were fairly satisfactory for a time, the back-pressure set up by the clogging of the material necessitated frequent attention and renewal.

On leaving the tar-extractors, which are under cover, the gas passed enters the A purifiers at a temperature of about 75° Fahr. Each box is 48 ft. by 36 ft. by 7 ft. deep, and contains three 12-inch tiers and one 10-inch tier of oxide. The tar and liquor produced from the bottom of the A vessel amounted to 13 gallons of tar and 16 gallons of liquor; the gas made and oil used being the same, and taken simultaneously with the test on the extractor. In place of the sawdust as a filtering material, breeze of about ½-inch cubes is used. Pan-breeze siftings were at first tried; but this material very soon became clogged. The present system of filtration, which has been employed on this particular plant for some three years without changing, seems to have proved the most successful; the breeze requiring no removal when the purifier becomes crude, as in the case of sawdust. The tar arrested seems to drain out, and the oxide remains practically free from tar. In plants Nos. 1 and 3, where sawdust is used in the purifiers, a certain amount of tar escapes through into the oxide—more so in No. 1 than in No. 3, caused partly by the purifying capacity of No. 1 being less than No. 3, in proportion to the makes of gas.

On comparing the filtering action of the purifiers with the fractionating one (if it may be so called) of the tar-extractors, the efficiency depends, in the first case, on the slow rate of travel of the gases and long time-contact; in the second, on the high rate

of travel and short time-contact. From observations made, it seems apparent that the very fine tar fog the extractor fails to eliminate, and which enters the first purifier, requires drastic handling—that is, if the whole efficiency of the purifier is to be made use of, and the bottom tier of filtering material dispensed with. Where space is at a premium, a rotary extractor seems to me one that recommends itself under these conditions.

No. 3 Water-Gas Plant.

(*Nominal capacity*, 1,000,000 *cubic feet per day*.)

The only difference in comparing the actual gas-making apparatus with Nos. 1 and 2, apart from the size, is that an extra board scrubber is placed after the condenser. As to whether the efficiency as a tar-extractor justifies its presence is extremely doubtful; the advantage in this respect being more or less outweighed by the back-pressure, especially so in the case of both plants working, as all the gas passes through the final scrubber. By substituting sieves of a slightly larger mesh, this difficulty has been overcome to a very large extent; and although the actual contact efficiency may have been reduced, the clogging-up or bridging-over of the meshes has been prevented. The present sieves are made up of 1½ inch by ⅝ inch wood ribs arranged chequerwise, as against the old sieves of 1 inch by 1 inch. These have been replaced in both scrubbers.

After leaving the final scrubber at about 85° Fahr., the gas travels thence to the relief holder through about 695 feet of 20-inch diameter cast-iron main, running in the open. This length of pipe condenses-out about 92·2 gallons of tar per million, or about 1 gallon of tar to every 4¼ superficial feet. The total length of main between the plant and the purifier is about 957 feet. The gas enters the holder at about 76° Fahr., and leaves it at about 80° Fahr.—a rise of 4°, the result of the water in the tank of the holder being circulated for use on the scrubbers of the water-gas plant. For this reason, no allowance has been made to the holder for any condensing effect.

From the exhauster, the gas passes direct to the purifiers, which it enters at about 80° Fahr., there being no tar-extractor on this plant. The purifiers are 40 ft. by 36 ft. by 10 ft. A tier of sawdust, 6 inches in depth, is arranged at the bottom of each box. This sawdust, on becoming crude, is dried and used again. In the case of No. 1 plant, however, the amount of tar contained in the sawdust is such that it prevents further use, and is disposed of as waste material. Below is given a table showing the amount of tar made from the water-gas plant, foul main, and the purifiers. The gas made in twenty-four hours is 1,166,000 cubic feet, the oil used 2612 gallons, the atmospheric temperature 63° Fahr.

No. 3 Water-Gas Plant.

Washer, Scrubber, Condenser, and Final Scrubber.		Foul Main.		Purifiers.					Total Tar Accounted For.
				Tar per Million.					
Tar per Million.	Tar per Cent.	Tar per Million.	Tar per Cent.	A.	B.	C.	D.	Tar per Cent.	
141·3 gallons.	45	133·0 gallons.	42·4	16·3	—	—	—	5·2	290·6 gallons.

Taking the oil used to produce 14 per cent. of tar, it will be seen from the above table that the water-gas plant—viz., washer, scrubbers, and condenser—produces 45·4 per cent., the crude main 42·4 per cent., and the amount filtered from the A purifier 5·2 per cent.—a total of 92·6 per cent., or 290·6 gallons of tar—the remaining 7½ per cent. passing through into the oxide. On this assumption, the amount of tar fog in the gas on arriving at the inlet to the A purifier contains 5·2 per cent. + 7·3 per cent. = 39½ gallons per million—no allowance being made to the relief holder for any condensing effect owing to the temperature being higher than the gas entering, as previously explained. The method employed to determine the amount of tar as shown above consisted of first of all measuring the actual amount produced from each part of the installation in three tests each of twelve hours run. Samples were then taken, and the percentage of tar ascertained by distillation. The result of the distillation test showed the tar contained a large proportion of light oils, a considerable portion of which could possibly be used as motor spirit.

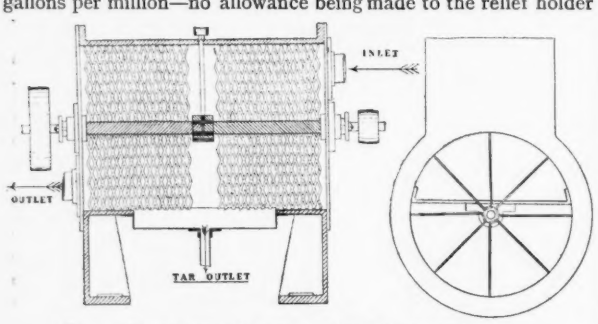


Fig. 3.—Experimental Apparatus for Extracting Tar-Fog.

The following is a description of an experimental apparatus (see fig. 3) that was devised by the writer for extracting tar fog. A similar one, only smaller and of rougher construction, was tried previously. The results were so favourable that the experiments were continued with one of larger dimensions. On referring to the diagram, it will be seen that the apparatus consists of a drum or casing, 20 inches in diameter by 2 ft. 6 in. long. Inside the drum rotate in opposite directions two shafts, on which are mounted eight blades or beaters; the one nearest the inlet making the greatest number of revolutions. Various patterns of blades were tried, consisting of different size diamond mesh and perforated plates. An experiment was made using two circular brushes, constructed of $\frac{3}{16}$-inch cord in place of bristles. These, when at rest, hung downwards, but on rotating became taut.

As will be seen from the following table, the tar taken out was less than in the case where metal beaters were used. On opening-up, it was found that the gas had gone the way of least resistance—viz., as near the periphery as possible; the centre half of the brush showing practically clean. The table gives the result obtained from the various speeds tried and blades used.

—	No. 1 Test.	No. 2 Test.	No. 3 Test.	No. 4 Test.
Type of blade	¾ Diamond mesh, ⅛ in. × 16G.	¼ Diamond mesh, ¼ in. × 16G.	$\frac{1}{16}$ in. Perforated plate, 54 $\frac{1}{16}$ in. holes to sq. in.	Brush $\frac{3}{16}$ in. cord.
Speed inlet, revolutions	1000	600	600	600
Speed outlet, revolutions	450	450	450	450
Temperature, Fahr.	64°	60°	63°	63°
Gas passed per hour, cub. ft.	1878	2020	1938	1800
Tar extracted, oz.	9·7	12·2	8	5·4
Liquor extracted, oz.	4·8	4·8	4	2·6
Tar per million cub. ft., gals.	32	37·7	25·8	18·7
Liquor per million cub. ft., gals.	15·8	14·8	12·9	9·0

At the commencement, a test was made with a speed of 2000 revolutions on the inlet and 1000 revolutions on the outlet, with the largest diamond mesh. These speeds, however, were discontinued; the temperature rising 35° Fahr. between the inlet and outlet of the extractor. This seemed to indicate that the speed was too great; the little tar that came out being of a dark colour and sticky nature.

It will be seen that No. 2 experiment gave the best result—38 gallons of tar per million cubic feet of gas being extracted. In order to ascertain the freeness of the gas from tar, a test was made on the outlet of the extractor, by passing 50 feet of gas at the rate of 5 feet per hour through a tube containing cotton wool; care being taken to connect direct on to the gas leaving the extractor. The result showed hardly any discoloration of the wool. There seems little doubt in the writer's opinion that a much larger quantity of gas could be treated by this apparatus; but owing to the meter being capable of dealing with only a maximum of 2000 feet per hour, this was not possible.

It will be noticed on each test that the temperature of the gas entering the extractor was exceeding low—viz., only about 63° Fahr., as against the 80° Fahr. entering the A purifier. The explanation of this is that the gas experimented on was taken from a 30-inch diameter main, 159 feet in length, with a dead-end. It will therefore be seen that the apparatus proved itself extremely efficient in eliminating the tar fog at such a low temperature. It was also thought that, owing to the amount of tar taken out, the light might have suffered. Tests were made accordingly on the outlet of the extractor; but no diminution in the candle power was found.

On enumerating the advantages and disadvantages of such an apparatus as I have described, the principal disadvantage, and the only one, is that it requires mechanical driving. This objection can, however, be minimized to a large extent by the apparatus being fixed on the outlet of the exhauster, and the same power utilized for driving the extractor; also, the small amount of space required lends itself somewhat to being easily adapted.

The results obtained from the first small apparatus made, the size of which was 18 inches diameter by 14 inches long, produced 90 gallons of tar and liquor per million cubic feet of gas; passing at the rate of 2000 feet per hour. The position of the apparatus being direct on the inlet to the A vessel, and the temperature of the gas entering the purifiers being much higher—viz., 80° Fahr—may account for the increased amount extracted.

DISCUSSION.

The President (Mr. H. O. Carr, of Wandsworth) remarked that this was an interesting paper on the question of tar from water gas, and it should promote a good discussion.

Mr. G. M. Gill (Wapping) thought that Mr. Harris had made out a good case for the discarding of frictional extractors of stationary form, and also he had shown how greatly was required a suitable method for testing tar-fog in gas. He (the speaker) had at different times tried to find out how much tar-fog was left in the gas; and it was extremely difficult to get any result. The extraction of tar from oil gas was a matter of great difficulty; and, so far as he knew, no one had yet brought out an apparatus which would really extract the whole of the tar. The usual plan seemed to be to allow the gas to filter through the oxide in the purifiers; but this was a hopelessly crude method. In many gas-works tar

extractors were fitted; but only about 70 or 80 per cent. of the tar was removed. Friction of one sort or another was the usual means; and also wire-drawing the gas through small holes, which, after all, was friction. But none of them removed the last 20 per cent. of the tar-fog in the gas. Something more than this was wanted. He had had experience of two extractors, which when used for extracting the oil from exhaust steam were efficient; but when employed for the extraction of tar from oil gas, they did not remove the last 25 per cent. of the tar. These two extractors, in conjunction with a box filled with small clinkers, arranged in series, had been used at Wapping for a year or so now; and while they did take out a great deal of the tar, yet enough was left in the gas to spoil the oxide. He had come to the conclusion that by far the most hopeful method of ridding the gas entirely of tar-fog was by adopting some sort of apparatus such as Mr. Harris had described. A machine of this kind should justify its adoption by reason of the additional tar it would extract from the gas for sale, and the increased value of the spent oxide.

Mr. J. H. Cornish (Bridgwater) said the paper contained some useful ideas with reference to the extraction of tar from water gas, which he agreed was a very difficult matter. In his own case, they passed the water gas through an extractor and through condensers in series; but he had often been surprised at the inefficiency of this plant. From these condensers, the water gas went to the relief holder; and this, he was sorry to say, was the best tar-extractor he had got. The gas at this point was mixed, and eventually passed through a tar-extractor of the bubble type; and this was absolutely efficient as a tar-extractor. Whether or no it would act with water gas in the same way, he was not prepared to say; but the inefficiency of the other extractors had always been a very great surprise to him. He was rather astonished to learn that the author got 14 per cent. of tar on the quantity of oil used. He himself had never thought he had been getting this. It had always been his belief that 10 per cent. was an outside figure; but he might be wrong. If Mr. Harris could give him any idea of the best means of removing water from water-gas tar, he would be very pleased. [Laughter.]

Mr. C. Chambers (Harrow) said that at his Company's works they had been making carburetted water gas for fourteen years. At the beginning they had a good deal of trouble with the tar getting to the purifiers and depositing on the bottom layer of oxide. In the early days, they only had one pipe leading from the condensers to the holder, and the exhauster drawing on it. Consequently, a good deal of the gas went forward without going to the relief holder. To overcome the difficulty, they put in a Livesey washer on the inlet of the purifiers; and from that day to the present time they had had no trouble whatever. The oxide as it left the purifiers was now practically the same as that from the coal-gas purifiers. They now used no breeze, sawdust, or other like material; but previous to fixing the Livesey washer they tried all sorts of remedies. What he did believe in was more thorough condensation. They brought their temperature at the condensers much lower than Mr. Harris did. He noticed that in his first set the author seemed to keep the temperature of the water up to supply the boilers. At Harrow, they were in favour of bringing down the temperature in the condensers, even to the point of running water to waste; and though they used the water for their boilers, they brought the condenser temperature down, and then re-heated the water by passing exhaust steam through it. He thought more thorough condensation would do away with the need for these mechanical appliances. At any rate, this was their experience at Harrow. They found no tarry deposits even in the syphons.

Mr. Thomas Glover (Norwich) said he would like to confirm what had been stated as to the efficiency of the Livesey washer, when worked with oil as the liquid. He spoke from the point of view of coal gas. After the condensers, he used a Livesey washer charged with coal-tar distillates, and it was a most efficient tar-fog remover. It was so efficient that the scrubbers never needed any cleaning out. In the second scrubber he had two large plate-glass windows underneath the grids; and it was possible, when the Livesey washer was acting as a tar-extractor in the way described, to see through the two plate-glass windows to the yard beyond. A few minutes after the Livesey washer had been stopped, however, there was such a cloud in the second scrubber that it was quite impossible to see inside. It had been said the relief holder was the best tar-extractor. He supposed this was because the gas came to a condition of rest in there. He did not think the globules had always formed before the gas got to the relief holder. The naphtha formed in the relief holder was very nicely charged with benzol. If they distilled this off, they would get excellent benzol. His Company ran their commercial car on it for a long time.

The Hon. Secretary (Mr. W. E. Price, of Hampton Wick) said they must admire the efforts of Mr. Harris to take out this tar. He considered the reason why some thought one thing and some another on this matter was because of the different conditions of working. Some worked the plant continuously, some intermittently, some with large relief holders, and some with small ones; and these variations made all the difference. Where one would have no trouble, another with a small relief holder and a plant working continuously would be under different conditions altogether. He would like to ask Mr. Harris if he had tried such a method, for instance, as cyclonic action of the gas. Dr. Colman had devised a piece of apparatus which he called the "Cyclone," in which the gas was taken into a cylindrical vessel tangentially, and caused to swirl round, passing ultimately out from the top, after having had to pass to the bottom because the outlet was carried down as low as possible. When their apparatus was first started, there happened to be houses very close; and they did all they could to prevent tar getting on to the side plates of the relief holder. He put down one of the "Cyclones," and was pleased to say that the method had proved very beneficial. Speaking roughly, from 40 to 50 per cent. of all the tar that was recovered from the gas was taken out in this "Cyclone." Where a large relief holder was used—such, for instance, as a 250,000 feet holder for a make of 500,000 feet in the 24 hours—made, of course, all the difference. In his own case, he made intermittently. The gas was stored and used as required; and they found it had a wonderful effect in bringing down the fog. He could sympathize with Mr. Harris in his trouble with oxide; but with the method he (the speaker) used, and the size of apparatus, he had never had trouble with the oxide, though it was, of course, very easy to get it. He supposed there was no better filter than oxide for tar-fog; but it was rather hopeless when they wanted to use it as a purifier.

Mr. H. C. Head (Winchester) congratulated Mr. Harris on the admirable way in which he had succeeded in doing what he set out to do; but he said his own trouble was, Why did he set out to do it? It was stated in the paper that about 2½ gallons of oil were used for 1000 cubic feet, and something under 11 per cent. of this was a beautiful tar-fog, which was largely benzol, which had been put in somewhere else and called an enricher; and then he put himself to the pains of taking it out of the gas. It struck him (the speaker) that the right direction of effort was to do what he could to keep it in the gas, where it might have been of some use. Was it not possible to mix this with the poorer coal gas in the earlier stages (not later than the inlet to the exhausters), so as to get the tar-fog or the benzol portion taken up in the mixed gas, and carried right forward on to the district, to the general advantage of the gas that was being made? He had had a water-gas plant some years now, and always endeavoured, once he got the oil into the plant, to keep it there as long as possible. He did not know whether he had been successful; but he had never had a tarry purifier, and had not suffered from the other difficulties of which they had heard.

Mr. Harris, after thanking the members for the way in which they had received his paper, said that the results perhaps were not as conclusive as might have been wished. His purpose, however, was more to hear from others as to their views on rather a "dark" subject—and, he thought he was right in saying, a subject that had not before been discussed by the Association. The extraction of tar from water gas was a matter which had been very much neglected by gas engineers in the past. It was not at all infrequently—in fact, one might say in most cases—that acid manufacturers refused to purchase parcels of oxide, owing to the amount of tar in the material; and the result was that not only was there a loss in this direction, but in some instances they had to pay for the material to be removed as rubbish. He had heard of one company getting over the difficulty by burning it under their retorts. Accordingly, it seemed necessary to him that there should be an extractor between the exhauster and the A purifier in every plant. It would pay for itself very soon. In reply to a question that had been put, the 14 per cent. of tar was taken on an average of five years—that was to say, ten half years. He had had no experience of Livesey washers; there were none at the works of the Company with which he was associated. Neither had he had any experience of the "Cyclone" method of treating tar-fog in water gas. It was very difficult to compare results. The variation in the temperature and flow of gas, and time-contact, all made it extremely difficult to compare one plant with another.

A vote of thanks was accorded to the author, on the proposition of the President.

Sir Hallewell Rogers, formerly Lord Mayor of Birmingham, has been appointed Honorary Colonel of the 3rd South Midland R.F.A. Brigade.

Mr. Thomas A. Braddock, of London, has been appointed a Director of the Aldershot Gas, Water, and District Lighting Company, in place of the late Mr. Richard Bateman, who, as announced in the "Journal," recently died as the result of an accident in the hunting field.

At the ordinary meeting of the Society of Engineers next Monday, a paper on "The Corrosion and Rusting of Iron" will be read by Mr. Eric K. Rideal. The author will deal with the chemical composition of rust, and explain the electrolytic theory of corrosion. He will show why the corrosion of iron in concrete is not more prevalent, and offer some remarks on corrosion due to external electric currents and in water-pipes. The various means of protecting ironwork will be described.

The late Mr. Sophus Simmelkjör, whose death was announced in the "Journal" for the 14th ult., left estate of the gross value of £47,483, of which the net personalty has been sworn at £47,092. Among the bequests is a sum of £500 to two clerks formerly in the office of the Cagliari Gas and Water Company, of which deceased was for some years General Manager and Engineer. Subject to bequests to members of his family and intimate friends, amounting to about £25,000, the testator left the residue of his property for division between various hospitals.

A NEW SULPHUR PURIFICATION PROCESS FOR COAL GAS.

A process which has been recently patented by Mr. G. H. Hultman, of Stockholm, for the removal of impurities from coal gas, has several points of interest. The English patent specification has not yet been issued; but the United States specification for the process is now published, and is No. 1,073,605, dated Sept. 23, 1913. A description of the process, which, we understand, is being tried on the laboratory scale in gas-works in Sweden, Holland, and this country, has been furnished us by Mr. Gustaf Graf, of Stockholm, who has acquired the patent rights for the whole world.

The process aims at the extraction from gas (which has already been freed from sulphuretted hydrogen by the ordinary methods) of carbon bisulphide, naphthalene, and benzol in a single operation. It is pointed out that the high proportion of sulphur in the gas from most descriptions of English gas coal is detrimental to the use of gas, owing to the corrosion of metal work, &c., which it causes on combustion. Also, that the removal of carbon bisulphide is not so imperative in the case of gas made from German coal, owing to the lower proportion of sulphur it contains. Hence the processes for the removal of carbon bisulphide from gas are of more interest to gas engineers who carbonize English coal. A method which admits of the extraction at a low cost of sulphur compounds from gas would enable the gas engineer to use certain coals which have hitherto been put outside the category of gas coals on account of their high content of sulphur.

The utility of a cheap process for the extraction of naphthalene from gas need not be laboured. The extraction of benzol from gas intended for town supplies is a procedure to which attention has lately been directed; and many questions of economic significance arise in connection with it. The Hultman process extracts benzene and its allied hydrocarbons from coal gas, but a certain proportion of them may be returned to, or retained in, the gas in order, if necessary, to maintain it at a certain standard of illuminating or calorific power.

The process consists in washing the gas in a rotary washer with alcohol, cooled to a temperature of − 5° to − 15° C. [+ 23° to + 5° Fahr.] by suitable refrigerating plant. At this temperature practically the whole of the moisture in the gas is thrown down, but formation of ice from it is prevented, owing to the condensed moisture being taken up by the alcohol, which, in the degree of dilution which it is allowed to attain in the washer, remains liquid at the temperatures employed. The cooled alcohol is stated to absorb about 80 per cent. of the organic sulphur in the gas, and practically all the naphthalene and benzol. The alcohol is run continuously through the washer, which is divided into two sections, each comprising a number of chambers. The first section contains alcohol which is cooled by means of either a refrigerating coil or else a refrigerating jacket; and the sulphur, naphthalene, and benzol are absorbed in the cold alcohol. The second section is not cooled, and has a sufficient number of sections containing water which absorbs the alcohol vapour carried forward by the gas from the first section. This water is allowed to attain a content of about 10 per cent. by volume of alcohol. The alcohol which has been saturated with benzol, carbon bisulphide, and naphthalene in the first section is afterwards mixed with the water containing alcohol from the second section. The dilution of the alcohol by this water throws the benzol out of solution, and this benzol retains the carbon bisulphide and naphthalene in solution. The specific gravity of the benzol, when thus separated from the alcohol, is ·89, and that of the diluted spirit, containing about 41 per cent. of the alcohol, is about ·95. The two liquids are passed into stills, the benzol being distilled with indirect steam, whereby the carbon bisulphide is driven off at 46° C. [115° Fahr.] and condensed. The residual benzol may then be purified according to requirements. The diluted spirit is rectified in the second still at a temperature of 80° to 100° C., whereby the alcohol is recovered for use again in washing a further quantity of gas. The water left in the still is returned to the second section of the washer.

An estimate is given of the quantities of materials used, and impurities removed, in the process for a works with a maximum make of about 6½ million cubic feet per diem. For this quantity the first section of the washer would require 18,188 lbs. (or about 2200 gallons) of alcohol, which would remove 364 lbs. of carbon bisulphide from the gas. About 440 gallons of alcohol would be carried by the gas into the second section of the washer, which would have to be replaced in the first section—making the total quantity of alcohol required about 2640 gallons. The alcohol would also absorb from the gas about 10,758 lbs. (or about 1210 gallons) of benzol. Thus the total volume of solution to be removed would be about 3410 gallons. In the second section of the washer, working to a strength of 10 per cent. by volume of alcohol, there would be about 4400 gallons of diluted alcohol. The cost of two washers, refrigerating plant with steam-engine, two stills with connections, tanks, and a house for the plant complete, is estimated at £8500, and the running charges, including depreciation, at £2750 per annum. This includes £525 for the loss of alcohol in the process. The commercial results of the process would depend on the extent to which benzol is recovered, or rather on the extent to which it is returned to the gas after extraction. The total quantity of benzol extracted for a works of the size named would be about 1114 tons. If only 90 per cent. of the benzol were recovered, this would mean about 1000 tons of benzol per annum, and benzol is now worth about £12 per ton. Similarly, the process should recover about 30 tons of carbon bisulphide, in addition to 7½ tons of other sulphur compounds. Carbon bisulphide is now quoted at about £18 15s. per ton.

The process has been investigated by Mr. E. Norlin, a leading research chemist at the Stockholm University of Technology, who has reported that the laboratory trials show that the process removes sulphur; and that probably, when applied on a large scale, it would remove more than 90 per cent. of the latter from the gas. The investigation has further shown that there is no loss of alcohol in the washer, but that there is a certain small loss in the recovery still, which, however, is not sufficient from an economical standpoint to preclude the use of the process.

In regard to the extent to which benzol may be extracted from gas intended for town supply, Mr. Graf has adopted the standard of calorific power which is commonly worked to in Germany and Sweden—viz., 5000 calories per cubic metre at 0° C., 760 mm., and dry [524 B.Th.U. per cubic foot at 60° Fahr., 30 in., and saturated], but points out that generally the calorific power of gas as supplied in these countries is 4 to 6 per cent. higher than this standard. The benzol in the gas, assuming that 0·8 volume per cent. is present, is responsible for about 29 B.Th.U. per cubic foot. Hence it is argued that a partial benzol recovery is quite practicable without prejudice to the consumers' interests.

Reference is made to a pamphlet on motor spirit from coal gas, issued by the Petrol Substitutes Committee of the Royal Automobile Club and cognate bodies, in which the bad economy of burning the benzol in gas instead of extracting a portion of it is emphasized in the interests of motor traction. The recovery of 20 per cent. of the benzol in gas is stated to cover the working expenses of the new process, and consequently, if this proportion of benzol is recovered, the sulphur and naphthalene would be extracted from the gas free of cost.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

Quarterly Meeting at Perth.

This Meeting was held in the Museum, Tay Street, Perth, on Saturday afternoon. Mr. WILLIAM GEDDES, of Granton, presided over a representative attendance.

The PRESIDENT, in opening the proceedings, expressed the pleasure it gave him to be with the members once again, taking part in their proceedings. Trouble, he said, came at awkward seasons, and, as most of them were aware, Mr. Vass would unfortunately not be with them because of a cycling accident which happened to him. He (the President) was quite sure he was expressing their thoughts when he said they sympathized very much with Mr. Vass, and hoped he would have a speedy recovery and be restored to his usual health and strength. He deplored Mr. Vass's accident for another reason. They had on their *agenda* a paper on "Gas Purification," and Mr. Vass took a very deep interest in the subject. Had he been with them, he (the President) was quite sure he would have told them something interesting and instructive. The first item on the *agenda* was a paper by Mr. Henry Doran, of Granton, on "The Purification of Coal Gas." Mr. Doran was a gentleman whom most of the members knew very well, as he had belonged to the Association for a number of years. The subject was one to which great attention had been given. Mr. Doran's plan in writing the paper was to present a straightforward survey. Purification, as generally understood, meant the removal of the sulphur compounds with the carbonic acid; but Mr. Doran had treatedit in its wider and more practical sense, and included other processes from the time the gas left the retort until it was put into the holder ready for the consumer. He (the President) need not dwell upon the importance of purification; for, though Scotland was not worried by any sulphur clauses such as there were in England, yet everyone knew the absolute necessity of efficient purification. He might remark that he was very glad to see that lime as a purifying material was falling into comparative disuse. Of all the filthy, dirty occupations at the gas-works, lime purification was the worst. It was a strange thing that, notwithstanding the great advances made in recent years in every branch of their works, the process of purification had not undergone very much change. It seemed to him that it was only quite recently that it had received the attention it deserved. However, they now had Dr. Davidson and other eminent men occupying themselves with its study; and while they all hoped that purification in closed vessels might become a thing of common use, it was not in the near future.

Mr. DORAN then read his paper, which, with a report of the discussion upon it, will be found on p. 683.

Mr. A. R. WILSON (Perth) followed with a paper entitled "Notes on Sulphate of Ammonia Manufacture." It will be found, with the remarks to which it gave rise, on p. 685.

At the close of the business the members and a few friends took tea together.

THOUGHTS: BY ONE WHO THINKS.

By William D. Helps, of Leeds.

[A Paper read before the Society of British Gas Industries, Nov. 20.]

This Society of which you have elected me Chairman has, I think you will all admit, arrived at the age when we should be leaving the nursery governess, the old matron's school, or the girls' school for a boys'. We, as you know, only date back to the time of the holding of the gas exhibition at Earl's Court in 1904. Many of us, who are active members to-day, took little or no interest in the fortunes of the Society in the earlier stages of its history. As with all other new societies, it fell to the lot of a few to do the spade-work; but with the shrewdness of those few, and with the careful selection of men of high standing and ability as Presidents, we may say without doubt that we are now safely launched, and increasing every year in influence and power for the accomplishment of the purpose aimed at by the Society—co-operation in commerce, and specifically in relation to coal gas and its progress.

Ideals, Aims, and Objects.

The Society, I think, may also be congratulated on the careful selection of their Council from time to time. It is a pleasure to attend the meetings and to realize how well that mutual aim of doing the best we can for the manufacturers of the gas industry at large is kept in view. Competitors with all their force sit side by side, debate on most personally interested matters, but, in every instance in my experience, with the silk glove, showing that what our veteran President for 1909, Mr. Thomas Newbigging, drew attention to in his presidential address has not been overlooked—viz., tact with all similar attributes. I take it other attributes include the grand old proverb quoted by the late Sir George Livesey, "Live and Let Live"—a motto which, I would humbly submit, we would do well to indite visibly, though invisibly, in large block letters upon our commercial minds, and to suggest to our professional contemporaries. Professor Smithells in his address told us that success is attainable in both manufacture and commerce by men who have had meted out scantily that which is conventionally called education. I therefore suggest that we, as a Society, while cultivating education and science, should not lose the attributes of tact, courage, and the "live and let live" principle; remembering also that it is an essential for the manufacturer, as well as for the buyer, to cultivate a high moral nature, and to be humane—thereby reducing the hard, suspicious, grudging buyer to a minimum, and teaching us to remember that everything we part with has cost us something, and that what we receive is after all the compensation to which the producer is entitled.

The Society was formed by us as manufacturers to improve our conduct, in order that we might be the better able to improve the conduct of others, thereby creating that good and hearty feeling between the two parties—that of the buyer and that of the seller. When we arrive at the point of freely praising what we intend to purchase, and enumerating freely the faults of what we intend to sell, we may with some confidence set up a partnership with honesty. The combination of trust and confidence among us, I feel sure, has become so largely developed that we need have little anxiety for the future. Our credit one with another has become a custom, and a failure here and there only serves to accentuate the rule of honour.

However, we must, as a society of manufacturers, still look to all scientists for aid, to statesmen for direction, and demand the most gifted men and those of the highest faculties to enter our ranks as traders; so that an ever-increasing volume of gas plant, with all its accessories in growing perfection, may be at all times forthcoming—a consummation which all here assembled must fully desire. We must see that British trade and industry are encouraged as far as possible among us; and here let me suggest that we, so far as our particular industry is concerned, have not had cause for much anxiety. We are not much troubled by any preference for foreign-made goods by our clients, and we have established a position for British-made gas appliances in the markets of the world. The best of us have our limitations; yet in some way or another we can all contribute to the maintenance of that position by putting our best into the work that comes to hand; for, as long as it indicates advancement, we can, I am quite sure, rely upon its being appreciated and acknowledged in tangible form by those on whom we depend for our very existence.

The fleetest rider owing to a "good mount" may be first in at a fox hunt and gain the brush. We may in business through fleetness, and sometimes a good "mount" of slimness, secure the "brush;" but if it has much of the latter, it is not a clean deal, and consequently not of real intrinsic value. Good trading only is lasting and valuable.

Profits.

Sir Corbet Woodall, in his Presidential Address to us last March seemed to indicate that gas undertakings, owing to parliamentary restrictions, had all the troubles and difficulties to overcome, while we, the "ancillary" industries, had a mere walk-over, being out simply for gain. With all their parliamentary restrictions, gas undertakings under efficient management have no difficulty in making satisfactory, and in some cases liberal, profits. On the other hand, as representing competitive manufacturing concerns, the attainment of the same profitable results that gas undertakings achieve without anxiety is only accomplished by determined doggedness and untiring effort. We have to make our modest profits, while the great difficulty of gas administration is to dispose of the profits they so easily make. Gas companies must dispose of their surplus profits by reducing the price of gas. Corporation gas departments most certainly do not; and I am one of many who would like to see less of these profits handed over to reduce rates, but some of them given instead in a liberal degree to the gas consumer, who, I contend, has claim to get his cost of supply reduced, being thereby encouraged, and not, as at present in frequent cases, having to pay indirectly for the electric light consumer.

Co-Partnership.

No paper from a member of a society like ours would be complete without a word on the ever-complex question of labour and its compensation. We are all out to sell our labour to the highest bidder. But we must take care we do not deceive ourselves; for, though we may secure in money a high value, it may recoil on us and make that money of less value. Lack of confidence is to a very large degree responsible for this lasting unrest between employer and employee. It is stated by many that profit-sharing is the solution; but, while I quite agree that this is so if you can universally guarantee that all employers make some profit to share, I have never yet heard the solution when there is no profit, but a loss.

Education is also responsible for the unrest, and if we are educating the masses, why, then we have some compensation. Nevertheless, I am of opinion that we as a country get less for our £ *s. d.* under this heading than anything this nation has undertaken since William the Conqueror came over. Our late President, Sir George Livesey, told us that the labourer who had been a slave and a serf was now a hireling, and must ultimately become a partner. Lord Beaconsfield preferred aggressiveness to servility; and I think the former is much in evidence to-day. Man is destined without doubt to make enormous progress. International relations will impose an increasingly higher standard of life, and link us up through the increased interdependence of trading communities. In our particular trading, I suggest that we are already realizing this.

It has been stated that the day has passed for any manager to be satisfied by "merely interviewing some half-dozen commercial travellers a year." This is most refreshing, because it indicates that, in the very near future, full merit and efficiency must count. In my experience the ancient and ignorant contempt of the professional man for the trader has already become almost extinct. While on the question of actual merit, I would like to record the fact that, since the number of limited companies has increased, there are a great many temptations for us, as two bodies, to have contra accounts, gas shares and traders' shares. I do not know which has the advantage; but, if not carefully and generously viewed, it is possible through self-interest to create a state of affairs even worse than they were thirty years ago.

The Trader and the Consultant.

One of our Presidents also stated that "self-preservation is the first law of Nature;" and no doubt as each individual from his own spectacles sees others directing the assault upon him or his belongings, he becomes violent, and the more so if it is not purely from a just and uncolourable reason. Our late President referred to "rings;" and it must be admitted that anything approaching a ring or actual cornering of any particular industry, or part thereof, would be wrong. Yet the manufacturer or trader must, in like manner with the professional, co-operate with his brother trader in order to at least maintain his position, if it be at any time necessary. I think that most of us here realize how difficult it is at all times, and under all conditions, to see and agree with the views, as well as the actions, of the professional or consulting engineer; and we go so far as sympathising sincerely with him and would at times even go further and like to correct him, not only for any personal gain it may give us, but for the sake of the industry at large. We most of us must of necessity look askance at the consulting engineer who is in any way interested in trade which comes within direct line of his profession.

While on this rather delicate subject, I would suggest that gas-works engineers, managers, and secretaries divert their investments in remunerative lines other than those which must of necessity create food for scandal, although not always from the fact that, through their direct interests, it means their orders, irrespective of justice, being sent to those companies which they are interested in—far from it. I could enumerate many instances where it prevents orders going where on merit they should go. We as traders have all sorts of good ideas, not the least of which is that gas companies, gas corporations, gas engineers, managers, and secretaries should stick to their last, and when they have any good notion of something useful for the industry, should give it, or sell it, to us traders—they must not be both buyers and sellers. When I make this statement, however, please do not mistake my meaning, because we are always ready to fill up our gaps by the very best of those gentlemen coming over to our side, so long as they have a side; but no sitters on the fence, who are fattening by removing the cream off both bowls.

Kindred Societies and Harmonious Working.

We all of us are interested in the views expressed by various persons in relation to the ultimate formation of a society to include the whole gas industry. In my humble opinion, the matter

is very readily solved; for we have the Institution of Gas Engineers, the Society of British Gas Industries, and the British Commercial Gas Association. The latter is without doubt a most important and necessary Association—being a combination of the members of the two former Associations, *plus* any others eligible, and is capable of being thrown open to do all the work necessary for the industry as a whole. I feel that, so far as our Society is concerned, the work it was created for is being carried on in the best possible manner, and that neither through extension nor absorption could it be improved. While the Institution, on the one hand, directs its destiny, we, the Society of British Gas Industries, direct ours, and then, both coming out into the open, confer in thoroughly cosmopolitan form without fear or hindrance under the one common flag—the British Commercial Gas Association.

Here let me say, in passing, that the great exhibition recently carried to such a successful issue affords a striking illustration of the useful services which these three Societies can render to the gas industry when combined together for the promotion of its interests. I would like also to say how much every member of your Council appreciated the patience, and afterwards the confidence, of every member of this Society in following and endorsing the policy submitted as to a co-operative exhibition. You would, I feel sure, consider me wanting altogether in grace if I omitted to mention here how not only your Council, but every member, have appreciated, and even admired, the Herculean work so successfully seen through in connection with this exhibition. I refer especially to Mrs. M. A. Cloudesley Brereton and Mr. F. W. Goodenough; and may I be allowed to bunch the remainder of the Executive and say every member did his duty. The co-operative principle, brought about mainly in the first instance by Mrs. Brereton, has been pronounced a success by us all. It is agreed that some of our sections will benefit more readily than others; but I hope all agree that of necessity all must eventually share in the advantages consequent upon that successful effort.

Efficiency in Manufacture.

We, as manufacturers, have now for some time been alive to the necessity of efficiency in every direction, and the replacing of the rule-of-thumb methods by capable chemists—experts and specialists in every department—not overlooking our designing and drawing offices. Of this we are being continually reminded through our Technical Press.

Wool was the staple commodity of this country. Coal is now the staple commodity, and gaslight the light of this country, if not of the world. It therefore necessarily follows that we, as gas plant traders, have our share of the responsibility of maintaining it in its premier position. The best of us have our limitations, yet in some way or other we can all contribute to advance that which we are all engaged upon; and so long as it indicates advancement, we can, I am quite sure, rely upon its being appreciated and acknowledged by those whom we have more or less to depend upon. As sections, we must see that all are fully represented in our Society; and in our combined forces let us be alive to the possibility, if not the probability, of losing co-operation with combination of the respective sections—*i.e.*, let each section in its turn have representation, avoiding at all times any personal glorification; the sole aim being success to our industry as a whole.

Friendly Relations.

General intercourse among us as friendly competitors must by no means crush out the need for closer and friendly intercourse with us as employers with employees; it being one of the greatest engines towards good feeling, sharpening up the knowledge and the possibilities of all those we more or less depend upon for the success or failure of our firms respectively, and for the ultimate success of the whole. I sometimes ask myself the question as to whether cheapness, and the tendency of adopting lightness of material as conditions, had made the commercial aspect of this country any the happier. However, this is part of business administration, and must be left to some extent to consumers to decide. I am inclined to think they are becoming more alive to the necessity for heavier and higher-grade goods.

Civic Representation.

We all realize the importance of selecting good, honest, and conscientious men for our public bodies. While the position is, in many instances honorary, we must fully realize that it must be filled by honourable men only—men with no axe to grind, and free from all fears or threats whatsoever. I do not hesitate to say that the position of a city councillor in our local government gives a more valuable opportunity for building-up national life and service than can be found anywhere else—*i.e.*, these gentlemen must be, before all things, pure and as free from political humbug as is possible to find. I hold that there is no need to deal with municipal matters upon the lines of Imperial politics. Doubtless there are good men in all political camps. Let us elect these men for public life, and in this way secure business men in our various cities and towns. I am aware that I have public men listening to me; may they gain wisdom. I realize it is our duty to give out of the abundance of brains of this Society more men to direct the more important matters of public life; and not the least among them the matter of the distribution of wealth, which is not of necessity £ *s. d.*

Capital and Labour.

I think that we are all agreed that honest labour, carried out by honest labourers, is as valuable an asset as we have to-day. What is a sovereign? What is its value? I hold it is just what the labourer makes it. If he wants three sovereigns for work done which he previously carried out for one, I am not sure that it matters much; for, after all, this action will only reduce the value of a sovereign down to 6s. 8d.—*i.e.*, it is a mere token, and has a market price and, in exchange, a power of purchase of its value which, by the action of strikes, may be reduced to the extent that our sovereign will have to be made of even less valuable metal. We must, I think, admit that one of the most difficult and complicated relations existing between employer and employee is that while many are engaged for a definite rate of wages and for a definite period, others vary according to the demand both in employment and rate paid. Under these contingencies, it does not allow for any action of affection to take place, but only an explosive action of disaffection. Two points offer themselves for consideration in this matter: First, how far the rate of wages may be so regulated as not to vary with the demand for labour; and, secondly, how far it is possible that bodies of workmen may be engaged and maintained at such fixed rate of wages, irrespective of the state of trade, without enlarging or diminishing their number. Succeed in arriving at a correct decision on this point, and you have, I think, the roads made easy for the extension of profit-sharing, which, after all, when the workman is liberally treated, is certainly to my mind one of the main solutions of this unrest in the labour market.

I realize also that there is wanted a solution of a difficulty more important than that of satisfying the honest workman; for most assuredly when you deduct the "boy-man," who, of necessity, requires time to mature, the honest workman, in my opinion, largely predominates. I refer to the wont-workers of the market, and the ever-grumbling-discontented-generally-half-efficient-workman. At the present moment, discontent has the worker in its grip; and the country is to a large extent in the workers' grip. The wages of a workman whose work is intermittent should of necessity be higher than if it were assured and continuous; and no matter how severe the struggle is, if a workman is assured of only three days' work per week he must have opportunity to secure for himself, and those dependent upon him, a sufficiency to keep them during the other four days. Is there not a fault on both sides? While the master, on the one hand, cannot allow any opportunity of gain to escape him—rushing frantically at every gap and breach in the walls of fortune, raging to be rich—the men often prefer three days of violent labour and three days of looking on at football matches, dog racing, or the like. It behoves us, as principals and as men wanting to help our workmen, to set about and, where necessary, check these disorderly habits in ourselves and afterwards in our men.

One solution, though with the present temperament of men a doubtfully acceptable one, is to consider lower wages for regular 48 hours of honest labour per week. We are reminded by a great writer that, while the soldier has to defend his country, the pastor to teach it, the doctor to keep it in health, the lawyer to mete out justice, we, manufacturers and merchants, have to provide the daily necessities of life. It behoves us, therefore, to realize what faithful service is, to be independent of what others may think, seeking no empty recognition from man, but rather the spirit to develop, as business men, the principle of carrying forward, for the benefit of this Society and the world at large, influences that in future ages may be appreciated by those whom we hope may further our good intentions.

Workmen's insurance, though it may be a skeleton or perhaps a framework to develop into something more acceptable to us, does not, I think, at the present time appeal to the majority. Federations of masters may be strong in many directions; but I would nevertheless advocate your seeing to this, and satisfying yourselves that we are true to the common interests of all those employers whom it is necessary to link-up.

Railway Rates.

Railway companies and rates, water-ways, and other important matters, are in my opinion requiring our attention in various districts; and while I am aware that many of us do take a lively interest in our respective local Chambers of Commerce, I suggest that there is room for a stronger interest, and more support, in this direction than we at present show. After all, these matters, such as railway rates, &c., can be more efficiently directed through this source than any other known to me. It is therefore to our common interest to secure more members, to endeavour to induce leading and capable men to take more interest in the local chambers, and above all to see that only efficient men, with the proper necessary knowledge, represent us in foreign countries and that these appointments are not merely used for dumping relations of men in high places. I trust that, for all time, politics may remain outside the assembly of the chamber; for they are to my mind both old-fashioned and degenerate.

Relations with Gas Manufacturers.

While we have heard a good deal from various directions of the fact that gas, as a commercial success, has now existed for one hundred years, you will, I am sure, expect me to refer to it. I submit that, as manufacurers, we have all of us to admit the enormous advance that has been made in our relationship as friendly competitors. I admit that there is jealousy; but, where there is no jealousy, there is no love. We have all to congratulate ourselves upon the exceptional good feeling predominating among us and our respected buyers—I mean gas authorities—and

which we all sincerely hope may continue to grow in grace and purity. I am reminded that the first service of the head of the gas profession (I refer to our late President, Sir Corbet Woodall), when taking over the direction of the Gaslight and Coke Company, was to bring about a revolution in their policy in favour of the public, by the establishment of a Sales Department to advertise the uses of gas with all its possibilities, and by good service to create popular feelings with all desirable customers. We wish him, as well as all other heads of gas companies and corporations, increasing success, and at the same time we do sincerely hope that they may not be as I have already described ever-ready to rush in as manufacturers, raging to grab through impatient covetousness at everything. Finally let me intimate that in my opinion, in order to secure the best returns and the very best value for money, the wiser plan is for gas authorities to continue to manufacture gas and its immediate relations, leaving us to look after the manufacture of necessary plant, and see that we are, by every power of efficiency, justified in offering the strongest resistance to any signs of interfering or manufacturing what we as a Society claim as our portion.

I would also like to here affirm the desirability of exerting all our influence to prevent gas corporations from extending municipal trading in any direction that conflicts with our legitimate business. I am personally very suspicious of so-called public-spirited men who, while talking against it, frequently (though perhaps sometimes unconsciously) hold up both hands for it. I think for the friendly relationship between this Society and the great industry that we represent, those assembled here have their own special responsibilities. Yet we should take a greater part in public affairs, and influence our fellow-men in the questions which go far beyond the province of merely manufacturing goods, but which extend to that important factor, society.

Power and Responsibilities of the Society.

As yet further development of trust—not trusts—grows up among us, we shall have special opportunities to influence opinion. When I look at the history of our calling of a hundred years, I am impressed by our responsibilities and our duties. Matured thoughts and ideas through this Society have power, and can deeply affect public opinion if rightly directed. On the other hand, it is easy to fail to realize our power. Let us not, therefore, allow our opportunity to pass with a too-timid modesty. Should we let it pass now, in my opinion a real opportunity for doing good will have been missed. Self is the first law; let our second be the looking after our interests through interesting ourselves in public life through this Society. We need say nothing more; we need pass no cut-and-dried resolution. It is the spirit and not the letter that is the one thing needful. Oneness of aim, unity of purpose, and identity of interest. Intercourse among the employers and employees is one of the greatest engines towards good feeling; and we must realize that the old days of rule-of-thumb have passed, and knowledge is now founded, not upon mere practice, but largely upon the highest and most elaborate scientific training. With the advent of this new period had come a greater demand for this mutual intercourse for those who are expected to carry out designs and plans to the actual working and efficiency, and who are to-day men of intelligence and education, requiring the right sort of practical encouragement. I believe that this Society may be a centre of good to all engaged in the hard practical aim of success to gas light; so that, with mutual benefit and friendly coalition of ideas and interests, the industry we all have at heart may attain higher efficiency, which it behoves every member of our Society to endeavour to promote, whether on a small or great scale. Humble in success, courageous in failure, absolute and confident that the future of the industry will witness more than we dream of, each of us should be content to lay the foundations of progress, though passing away ere the fruits of his work can ripen. These are the ideals at which we, as manufacturers, should be aiming to-day.

DISCUSSION.

The President (Professor Harold B. Dixon, Ph.D., F.R.S.) said he should like to remark with what interest he had listened to Mr. Helps; and he believed that he agreed with nearly everything in the paper. If he did not agree with everything, it was probably because he had not properly understood it. He was, however, quite clear in agreeing with his friend in what he had been saying as to the responsibilities of the members of the Society. He believed that much they had heard was of serious importance to all of them; and he believed that members of the Society could do great good in their several spheres if they considered the address and acted upon it as best they could. Mr. Helps had touched upon a great number of points. Education, he said, was partly responsible for the great unrest among labour. He also made the strong statement that since William the Conqueror came over, they got less for everything they paid for in this country. He (the President) did not remember what William the Conqueror paid for in this country; but he rather thought he got most of what he did have on credit. [Laughter.] At any rate, this country was paying an enormous amount for education —34 millions a year. It was a colossal sum. Of this, 4 millions went for higher education; and for the highest of all—University work—only £200,000 was being spent by the Government. At the end of his address, Mr. Helps used words which he (the President) would like to say were really founded, he believed, on experience and knowledge. At any rate, he should like to feel that they were. "Knowledge," he said, "is now founded not upon mere practice, but largely upon the highest and the most elaborate scientific training." He (the President) believed this to be true; and he also believed the real future of the industry did very largely depend upon the highest kind of scientific training. It was well, therefore, that they should ask whether they were getting value for the money spent on education, or were they spending too much on elementary education, or were they not devoting it in proper proportions? He believed they were spending an enormous sum on elementary education which led to very little result. He wanted to give every lad a chance; he ought to have it. But to let things slide on when a boy was not fit to profit by it was a mere waste to him, and to the ratepayers. Mr. Helps had been putting forward views that they should be idealistic. In one phrase he used he particularly aimed at a high ideal. He said: "It is essential for the manufacturer, as well as for the buyer, to cultivate a high moral nature, and to be humane, thereby reducing the hard, suspicious, grudging buyer to a minimum." He (the President) would prefer to bring the buyer up to the maximum; and he thought Mr. Helps really meant this. [Laughter.] It was only his idealistic way of putting it. He had also given great credit to those who were connected with the National Gas Exhibition. He (the President) spent two days there; and afterwards from everyone from whom he heard on the subject, it was spoken of as a great success. Mr. Helps said, in specially naming certain of the workers for the exhibition, that for the rest he would bunch them together. But there was one other name that ought to be specially mentioned, and that was W. D. Helps. To him they owed much for what he did towards promoting the success of the exhibition.

Mr. W. J. Broadhead said the title of the paper was particularly well chosen. The contribution was full of thoughts; and these gave them individually food for thought. Mr. Helps was to be congratulated on the many interesting subjects with which he had dealt. They all agreed with him that it was not for the benefit of the gas industry that gas profits should be used in aid of the rates; and it must be very gratifying to them to think that Parliament held similar views. When corporations had gone to Parliament for fresh powers, they had had limitations placed on them. Oldham and Salford were now tied-down to a contribution from the profits to the rates of a sum that was about equal to 1 per cent. on the present outstanding capital. This was very gratifying. Their Chairman could not, and no doubt did not, expect them to agree with all his points. For instance, he said that there were a great many temptations for them, as two bodies, to have contra accounts—gas shares and traders' shares. He (Mr. Broadhead) refused to be censured by remarks in the paper. He believed in every man who had money to invest placing it where it would bring in the best return. His firm's reserve was entirely invested in gas companies. Therefore, he came under the objectionable heading referred to by Mr. Helps. But it had yet to come to his knowledge that any board of directors had given his firm orders because they were shareholders in their gas concern. There were some of the gas companies in which the firm were financially interested who did not even send them inquiries when they wanted new apparatus.

Mr. J. R. Phelps said, regarding the relations between employer and employed, he personally thought that a great deal of the discontent among working men was due to the misuse that trade unions were making of their powers and by being captured by political parties. When employers were told that they must pay the same amount of wages to every man whether or not he earned it, that was wrong. This was putting a premium on laziness instead of upon labour. If a man got 30s. a week for doing nothing, then many of them would try to do still less. [Laughter.] It was not right to employers or to honest, capable workers that any man should get a definite rate of wages whether or not he earned it. If they discharged a man, a long explanation had to be given to him or to his Society as to why he had been discharged; and why employers should not be protected against this sort of thing he failed to see. He deprecated the liberty that was given to trades unionists to drive or coerce men to join unions; and he said he should also like to see masters stand out against paying standard rates of wages unless fixed (say) by the State, but not trade union fixed rates, and for the full right to get the best men they could for the money they paid.

Mr. F. C. Tilley thought the tendency in the present day was for gas companies to overstep the bounds or the intentions of the Acts under which they were working. They were founded as gas companies with privileges in serving the community; and for the advantages conferred upon them, they were restricted to an area. But they were now doing much more than this. They were going into the manufacturing sphere, and were gradually becoming competitors of makers of gas appliances. This was only done to a small degree at present; but he thought the Council of the Society might do a great deal in influencing the members of the Institution of Gas Engineers to combat this new spirit and action. It was bound to grow if not strongly repressed from the side of the manufacturers, on whom it was working an injustice. Within the past few days, he had noticed that one of the large gas companies had gone so far as to advertise one of its specialities in the daily papers. The company were trying to sell outside their own area something with their own name attached to it; and it seemed to him this was going beyond the rights of any gas company. The Council of the Society should take the earliest opportunity of bringing this before the Institution of Gas Engineers, and maintaining that, even if the companies had the right

in their Acts to do this sort of thing, it was going beyond the spirit that should exist between gas companies and manufacturers. The help that the gas companies had received from the manufacturers, during recent years particularly, was not well rewarded by such opposition as they were endeavouring to create as against the manufacturers. Another phase of this particular question was that members of different gas companies and corporations had particular articles which they patented, and often they had gone so far as to supply these articles to other gas companies and corporations. Frequently, the fact that the names of individuals were attached to these things influenced purchase by other gas undertakings. He believed that some of the members of their own Society were manufacturing these goods; and they could not blame them, because there was a great temptation when a large company went to a manufacturer and said: "We have a speciality which we want manufactured; will you make it for us?" The manufacturers naturally took up the work; but if it were recognized that it was against the interests of the members of the Society that such things should be manufactured by gas company officials, which was tantamount to them being manufactured by the gas companies themselves, he thought a step forward would be taken which would be to their lasting good.* As to the question of education, to his mind the present system was very deficient, He agreed entirely with what had been said by the President, that the matter ought to be looked into very closely, and that some steps should be taken to reorganize the system.

Mr. A. P. Main said, in common with all present at the meeting, he appreciated very highly the interesting paper Mr. Helps had given them. He had no doubt that they all felt Utopia was a pleasant place, and they would all like to get there. With regard to the question of education, he hoped what had been said would strengthen any attitude of mind that the President might have on this subject in the way of endeavouring to allocate a very much larger portion of the local education grant to research work, where they had capable students, whose work undoubtedly, if it were properly supported by the State, as in Germany, would be of immense service to the nation. It was a singular thing that one never spoke on this subject to a teacher connected with the actual work of elementary education without getting the same answer—that the system was as bad as it possibly could be. The people who worked it condemned it. As to the waste of money, every teacher to whom he had spoken told him that, if the people of this country had any real idea as to the amount of it, it would be stopped at once. These things got into the hands of a branch of the Civil Service; and without depreciating the work of our Civil Service, anyone who had been behind the scenes of that great service must realize that it was not the place for pushing, nor were the officials the people to push, forward reforms. Many of the officials were extremely capable; but they were conscious that there was inertia in State affairs, which it was absolutely impossible for the most public-spirited official to overcome. The official was not thanked for his efforts; he was snubbed for anything he might do in the way of criticizing the Acts he had to administer. One other point of supreme interest to this country related to their foreign consuls. He (Mr. Main) had a long conversation just recently with a very able and successful British merchant, who had been practically forty years in South America. He asserted that, comparing this country's consuls with those of Germany, this country was constantly placed at a disadvantage. If it were not for the fact that British merchants looked after themselves to a great extent, they could never hold the place they were doing in the world to-day. They largely found, it had been said, ex-army officers—men who knew nothing of trade—put into these positions. He (Mr. Main) knew of one important town in South America where the consul was generally playing golf; and, singular to say, a parson wrote the yearly report on the commercial aspects of the community. This sort of thing was very serious for this country, because (on this point) the same man told him that thirty years ago in that town most of the merchants were British; but to-day the majority were Germans. In addition to consular work, it was notorious that the German office sent diplomatic representatives to reinforce their consular representatives. The British Government in this particular matter were hidebound by tradition. He remembered some time back having a long talk with the then British Consul at Buenos Ayres, who was a very energetic and capable man. He said that he saw the evil, but had long since ceased to report it. His reports simply went home, and were then pigeon-holed, and no doubt he was thought to be a big nuisance. Mr. Helps's paper had done great service in calling attention to this matter. They should all bear in mind that trade was being stolen from them, because the German worked in a more business-like way. From this country, half-pay officers were sent out, simply with the idea that trade did not matter. The British merchant had to look after himself.

Mr. Helps, in reply, expressed his appreciation of the graciousness and kindness of the members towards him, because he expected after some of the remarks he made in the paper that he would, at the close of the discussion, feel like a referee at a football match. The only speaker who had raised his voice was Mr. Broadhead. He understood him to say that, in his experience, shareholding in gas companies did not influence orders. If this were so, then possibly merit was not considered in the placing of the orders. He did not expect everyone to agree with him in what he had said. It was very interesting to him to have the support of Mr. Main in regard to consuls. With reference to Mr. Tilley's suggestion, he quite sympathized with it, and thought that the Society should do more. What was the Society doing? Much as it had done, there was much that was left undone, and this they must consider.

The President formally put a hearty vote of thanks to Mr. Helps; and it was enthusiastically passed.

Mr. Helps briefly responded.

* A letter from Mr. Charles Carpenter, D.Sc., on the subject of Mr. Tilley's remarks, appears in our "Correspondence" columns.—Ed. J.G.L.

ILLUMINATING ENGINEERING SOCIETY.

After the vacation, the first meeting of the Society was held last Tuesday at the Royal Society of Arts, John Street, Adelphi. Mr. F. W. Goodenough, Chairman of the Council, presided.

There was a little preliminary general business, in the course of which it was announced that during the vacation the roll of membership had been extended by 46 names.

WORK OF THE SOCIETY.

Progress and Prospect—Proposed Provincial Branches.

The Hon. Secretary (Mr. Leon Gaster) made a report on the work that has been proceeding in relation to the subjects which are being studied and followed by members of the Society. He said the increased attention that the medical fraternity, as evidenced at the International Medical Congress, was bestowing on the subject of the effect of modern illuminants upon the eyesight would assist the claims of good illumination. Passing reference was made to a visit by Dr. James Kerr to Buffalo in connection with the International Congress on School Hygiene. At the International Roads Congress, a special section was devoted to road and vehicle lighting; and it was interesting to note how generally the view was held that the lighting and upkeep of roads should be considered together. Even in regard to country roads, several members considered that ultimately the lighting might be made a national affair, at all events in the case of the great highways. The Joint Committee on the Street Lighting Specification were continuing their work, and were considering the revision of the draft specification put forward in Mr. Trotter's paper read last April. In an allusion to the National Gas Exhibition (upon which the Chairman had kindly promised to offer a few remarks), he said he thought they as a society should express their appreciation of the excellent opportunity of making their aims and objects known that was provided at the conferences held at the exhibition—an opportunity that was afforded largely through the enterprise of Mr. Goodenough. He might say that the Council, recognizing the great services of Mr. Goodenough to the Society during the past year, had unanimously nominated him a Vice-President. He (Mr. Gaster) was pleased to announce that Mr. Goodenough had also consented to remain Chairman of the Council during the current session. [The next part of Mr. Gaster's report was devoted to giving information as to the International Commission on Illumination, which has been built upon the foundation provided by the International Photometric Commission. We have so recently given particulars as to this expansion, the new Statutes, and the *personnel* of the Committee and honorary officers who will commence to guide the work of the new Commission into the larger spheres of illumination than the one of photometry for which the original Commission was set up at the International Gas Congress in Paris in the year 1900, that there is no need to follow Mr. Gaster's description of what has been done.] Incidentally, he announced that M. Vautier, the President, had consented to become a Vice-President of the English Illuminating Engineering Society. Proceeding, he said that there were now in existence Illuminating Engineering Societies in Great Britain, Germany, and the United States; and they might expect to hear very shortly of the formation of a similar Society in France. A preliminary step had already been taken in the issue of the new French journal, "La Science et Art de l'Eclairage," devoted to the subject of illumination, under the direction of Professor A. Blondel. In order that their Society might fitly take its place in this international movement, and in other pending developments, it was desirable for its membership to be considerably increased. During the vacation, there had been an increase of 46 members, and, what was equally satisfactory, the list included many who were prominently associated with illumination in their respective countries, and whose support should be of considerable assistance in securing the co-operation of kindred bodies. He might make special mention of one step recently taken by the Council in this direction. An invitation had been extended to the Institutions of Gas and Electrical Engineers that their Presidents should be *ex-officio* members of Council and Vice-Presidents of the Society. He was pleased to say that Mr. W. Duddell and Mr. Edward Allen, the Presidents of these two Institutions for the present year, had already consented to act in this way. In the course of the discussion of the paper "The Aims and Objects of the Illuminating Engineering Society," read at a conference at the National Gas Exhibition, Mr. R. G. Shadbolt made the valuable suggestion that the work of the Society should be extended outside London into other sections of the country; and the Council were now considering what steps should be taken in order to give effect to this idea. It was proposed to appoint representatives in various districts to assist in forming the nucleus of local branches. It

was hoped that before long the Council might be in a position to arrange for conferences in different districts at which papers might be presented of special interest to the locality. Meantime, it was hoped that members residing out of London would bear this development in mind, and make a special effort to interest friends in the work of the Society, which was not only national, but international, in its scope.

The National Gas Exhibition Conferences.

The Chairman remarked that they were particularly interested in the formation of the International Commission on Illumination. Though the Commission might move slowly, he believed it would do useful work in the course of years. He did not think they must expect rapid results from its operations. But its formation was a good thing; and they hoped it would go steadily ahead. His duty was to mention what had been done at the National Gas Exhibition to forward the interests of scientific illumination. He was not going to refer to the Gas Exhibition, as such; but he desired to report to the Society as to the papers read at the conferences held at the exhibition on subjects of general interest apart from the specific interest of the gas industry. At the conference of educationists on Oct. 11, the President of the Society (Professor Silvanus Thompson) read a most interesting paper on "Some Considerations on the Brightness of Lights." Professor Thompson gave a fascinating, and, as usual with him, a most lucid account of the measurement of illumination, and the relation between intrinsic brilliancy of light, and its effect upon eyesight and comfort. Following this was a paper by Mr. Gaster on the "Physiological and Mental Disadvantages of Unscientific Illumination." He (Mr. Goodenough) was sure the members would agree that it was of considerable service to the cause of scientific illumination at the conference (which was largely attended by those interested in education, and which was presided over by such an educational authority as Sir George Kekewich) that a paper should have been read emphasizing the application of scientific principles in the lighting of schools, in which the rising generation, in all too many cases, had their eyesight damaged through the illumination being far from scientific. At the same conference, a paper was read by Mr. Septimus Warwick, on behalf of himself and Mr. Austen Hall, on "The School of the Future." In this paper, the authors drew attention to the interim report of the Committee of the Society, who were inquiring into the question of the scientific illumination of schools. As the papers read at the conference would be widely circulated among those interested in the subject of education, he thought the members of the Society might feel that a good deal had been done to bring the question of scientific illumination before educational authorities. On Oct. 17, they fortunataly had Lord Rayleigh presiding over a conference devoted to scientific illumination. On that occasion, Mr. Gaster read a paper in which he referred to the aims and objects of this Society; and the useful suggestion was then made, which the Council were considering, for holding provincial conferences of the Society, so as to get the question of the laws of illumination into the newspapers more widely than it was possible to do by merely holding London meetings. The Council hoped to be able to secure the interest of the authorities in places like Manchester, Birmingham, and Glasgow, so as to be able to hold meetings under their auspices, in order to bring the question of illumination before the medical, scientific, manufacturing, and educational men of the districts. Mr. Franklin Thorp read a paper on the same occasion on "The Economy of Efficient Lighting," emphasizing the fact that good lighting so far from being a luxury was a necessity and an economical and profitable proposition, leading to the increased output of factories, and constituting a safeguard against accident. Dr. Meredith Young read a paper on "Light and Sight." It was a long and equally useful contribution to the subject of the relation of sources of light to eyesight. It was not a paper dealing in any way with illuminants, but with illumination. Finally, at the conference of manufacturers presided over by Lord Weardale, on Oct. 29, Mr. Gaster read another paper on "The Economic Value of Adequate Illumination," which would be widely circulated among the manufacturers of this country. Therefore, he (the Chairman) thought that, whatever the National Gas Exhibition might have done for the particular industry in whose interests it was organized, a great deal was accomplished with respect to scientific illumination *per se*, without any relation to any particular illuminant.

DR. KERR'S VISIT TO BUFFALO.

Dr. James Kerr, M.A., then reported on his visit to Buffalo in connection with the International Congress on School Hygiene. Among his remarks he stated that, in the section devoted to ophthalmic questions, illumination was also dealt with. Perhaps the paper read by Professor Ferree, of Bryn Mawr, who had approached the subject purely as a psychologist, opened up new ground. He attempted to analyze the factors in illumination which most affected ocular efficiency. Actual intensity of light seemed of small importance, compared with even distribution. He concluded that with an evenly illuminated space, fatigue was least, and that daylight was least tiring. The discussion ultimately turned mostly into the merits of direct and indirect lighting. Dr. Gstettner, of Vienna, read a paper largely discussing the adaptation of the eye to light, and the value of slight changes when the light was poor. In another communication, the subject of glaring paper was treated upon, and the difficulties it presented in largely nullifying the effect of good lighting, although well-distributed light also modified glare largely. Dr. Alger dealt with illumination chiefly from its effect on the eye in causing glare from high intrinsic brightness, and strain from rapid variations of light. Several other papers, including his (Dr. Kerr's) own, dealt with illumination of the class-room in the light of present-day knowledge without presenting any great novelties. One delegate—Dr. Weaver—was very catholic in his views. So long as light was well distributed, and the artificial lights high above the children's heads, he said he was satisfied. He (Dr. Kerr) dealt with glare as a primary and rare condition due to pathological changes in the retina, and a secondary common condition due to excess of peripheral illumination over that at the macula for which he assumed the eye to be adapted. The importance of these considerations in connection with wall decorations and artificial lighting was mentioned. He advocated for daylight a minimum of 10 foot-candles, and for artificial light the suggestion of the Committee of the Society of a minimum of 2 foot-candles. Better still some of the members thought it should be 2·5 foot-candles. In regard to systems of lighting, semi-indirect illumination seemed best for general school use. Among other interesting statements by Dr. Kerr, he said that the whole district about Buffalo depended for power and light on electricity transmitted from Niagara. Toronto, too, was similarly supplied; and while there he was much struck with the alterations in pressure—the lights slowly waxing and waning in intensity without flicker. Buffalo, on the other hand, through financial interests controlling the power, had to pay very heavily indeed for its lights. An interesting circumstance happened while at a reception held by the Buffalo Club. About 10.30 p.m., a heavy thunderstorm began, all the lights went out, and servants came running in with tapers to light candles in sconces on the walls. He (Dr. Kerr) thought of going off, but was told that the streets would be dark and no cars were running, as the power had been turned off at Niagara. It was so; and the whole of the city of 600,000 inhabitants was held up, so far as light and power were concerned, for 37 minutes by the thunderstorm.

The Chairman thanked Dr. Kerr for his interesting account of the visit paid to Buffalo. Suppliers of illuminants on this side wished the lighting authorities were as generous as the authorities were on the other side in the matter of street illumination.

SHADOWS BY NATURAL AND ARTIFICIAL LIGHT.

A paper on this subject was read by Messrs. J. S. Dow and V. H. Mackinney; but it does not bear complete reproduction, in the absence of the photographs. In showing the importance of photographs of shadows, the authors particularly mentioned the case of factory lighting. It might happen, they said, that an inconvenient shadow would lead to spoiled work or even an accident. If in all such cases, photographs showing the shadow conditions by daylight and artificial light respectively were taken there would be a very useful record of the causes of the mishap. There were, of course, many other instances of the importance of shadows to the illuminating engineer, especially in connection with the artificial lighting of rooms having claims to artistic and architectural distinction. One illustration showed the inconvenience that might be caused by the shadows from head or hand, owing to badly placed lights—a matter appreciated by lighting experts, but still not sufficiently recognized by non-technical people. By photographs of shadows thrown by artificial light on to a drawing-board, justification was given for the view that if local lighting were used for drawing-boards, the light should preferably come from in front of the draughtsman. Another series of photographs showed the effect of shadow when the light was respectively behind and facing the worker (*a*) by direct light from an unscreened lamp, (*b*) by indirect lighting. Only in the case of direct light from a lamp facing the observer was an inconvenient shadow produced. It was interesting to note that an indirect fitting even placed behind the worker did not cause a shadow that was marked to the eye. It should be explained that in taking these particular photographs the lights were arranged to give the same illumination on the table throughout (approximately 1 foot-candle). In order to illustrate the depth of shadow cast by the head, a reading of the surface-brightness of the lightest and darkest portions of the paper in each case was also taken. This led to a somewhat curious result, as shown by the following:

System of Lighting.	Surface Brightness.		Ratio.
	Brightest Part of Board. Foot-Candles.	Darkest Part of Board. Foot-Candles.	
Direct	1·06	0·38	1 : 2·8
Semi-indirect	1·06	0·50	1 : 2·0
Indirect	0·95	0·50	1 : 1·9

It was seen that, notwithstanding the more distinct shadow from the direct system, the numerical shadow-ratio was not so very different. Yet to the eye the shadow from indirect (and also the semi-indirect) units faded off so gradually as to be scarcely perceptible. The authors laid emphasis on the fact that photographs of shadows needed to be taken with considerable care, as the result might easily be falsified by very slight differences in exposure and development. Such points as those roughly illustrated in the photographs must be met with, in a more complex form, in many industrial operations, where the shadows cast by moving tools, cutting edges, &c.

were highly important. It should be remembered, too, that different conditions were met with when there were a large number of units. With direct lighting, multiple shadows resulted.

Then the authors illustrated the fundamental difference between the shadows cast by indirect lighting and by an unscreened source in an ordinary room. One of the most striking features of indirect and semi-indirect lighting was the way in which the light got into corners and underneath tables and other furniture. This was a particularly useful point where there had to be under-examination of machinery. In connection with street lighting, there was, the authors suggested, room for an entire series of photographs showing the conditions, as regards shadow, of the present methods of street lighting. In the streets, as in large halls, it was difficult to produce an impression of bright illumination even by the use of very powerful lamps; for the effectiveness of the lighting was considerably limited by the fact of so little assistance being derived through reflection from surroundings.

Having shown by several examples the value of well-diffused illumination, the authors turned to cases in which light coming from all directions was just what was not required. A photograph was shown of an inclined board, lighted by an adjustable lamp fixed in an opaque reflector, which was used by printers in examining the "lay-off" sheet. In order to show up the irregularities in the surface, one required light striking the paper very obliquely. Where the light struck the paper at angles nearer to the vertical, one could not see the projections nearly so well. To a person reading a book in the ordinary way, light striking the paper at a small angle of incidence was most convenient; and very oblique rays, which showed up the defects, were objectionable. But to the expert, searching for these defects, the exact contrary condition was desired. It was a question worth asking whether, in the examination of fine worsted, or various qualities of cloth, the same reasoning might not apply. For the expert, in examining such materials, was guided very largely by any small irregularities in their surface; and one would be inclined to think that these could best be displayed by oblique rays coming from a source of small dimensions, and therefore casting fairly marked shadows. It seemed also to the authors to be a fact that most people who were engaged in operations like knitting and sewing preferred a strong local light—possibly because they could then examine small differences in texture more readily by moving the material, and so altering the incidence of the light.

In connection with further photos., the authors expressed the view that, especially with more distant lights, pure indirect lighting might not be so good for the illumination of highly polished objects as direct or semi-indirect systems; for in order to show off goods of this kind one relied upon the sparkle produced by reflected images of lights on their surface. And unless one had somewhere in the room sources having a fairly high intrinsic brilliancy, one could hardly expect to get marked sparkles of this kind. The problem when to aim at diffused illumination, and when to use uni-directional light, also occurred in connection with the general lighting of interiors. For example, it did not seem to be definitely settled what variety of shadow was best adapted to showing off statuary, carving, &c. The value of oblique rays in showing up mouldings was also demonstrated by a view of White's Club in St. James's Street on Coronation night. The artificial lighting of the face of the building was in this case obtained from two lines of concealed tubular lamps in trough reflectors, which were specially shaped to give an even illumination. It was seen by the photographs that the mouldings stood out in much stronger relief and were much more noticeable by night than by day. In further photographs were exemplified other characteristic differences between natural and artificial illumination. By the courtesy of the Allan Company, the authors were granted permission to take two views by day and by night in the office of the Company in Cockspur Street. This was selected as an excellent example of the "reversal of shadow" by artificial light. In the view taken by daylight the pillars stood out white against a dark background, while with the artificial light an exactly opposite effect was obtained, due to lamps concealed behind the pillars. Here, again, some writers asserted that these shadow reversals were unnatural, and should be avoided. Was it necessary, the authors asked, for the effects characteristic of daylight to be imitated? Seeing that artificial lighting was itself radically different from daylight in its distribution and arrangement, it seems unreasonable to try and force it always to give the same kind of shadows. The more one examined and considered these matters, the authors remarked, the more one was struck by the important part played by shadow in almost all problems of artificial lighting.

Discussion.

The discussion was opened by the Chairman remarking that the members were much indebted to Mr. Dow for reading the paper, and to Mr. Mackinney for the part he had taken in its preparation. The second contributor to the discussion was Mr. T. E. Ritchie, who thought the indebtedness to the authors was of greater extent than might at first be apparent. In his opinion, the time had arrived when more scientific and more accurate work ought to be attempted in the matters of shadows, and of information pertaining to such photographs as were submitted to the Society. It was perhaps impossible to determine shadow values mathematically or to express them as a ratio; and there was not the slightest doubt that it was equally impossible, with the best intention in the world, to always express them accurately pictorially. By different processes and different workers, results were given which were not comparable; and the Society would be doing a good work if they were able to fix definitely the question of the correct expression of shadow values photometrically. It was thought by Mr. Haydn Harrison that photographs were the most deceptive things in showing degrees of illumination. In street lighting, there was an importance in shadows. He thought it was Dr. Louis Bell who spoke of the importance of producing a shadow which would draw attention to the object throwing it; and there was an importance in shadows from this point of view. Mr. R. J. Wallis-Jones contributed to the discussion; and then the Chairman raised a laugh by saying that the impression created on his mind by the paper was that photographs of illumination seemed to be deception carried to a fine art, and they appeared to fulfil all the qualifications required from an expert witness. Mr. Dow had referred to the question of people working with dark materials and so on preferring a small unit of light rather than a general diffusion of light; and the author thought this was due to a desire to get light at the correct angles on the work. Was it not also a possible explanation that, when one was working in a way calling for close application to the work, the eye liked to be able to look away from the illuminated work to something that was considerably darker. He believed it was the case that the sorters in the General Post Office, when good general illumination was substituted for local illumination, did not approve of it for their sorting work, because they found their eyes had no relief in looking away from the letters to the surroundings; whereas if they were able to do their work with an adequate light, and then were able to look away to an illumination of much less intensity, the eye got the relief for which it was seeking. This might be a partial explanation for the preference for small units of light near work calling for close application. The practical aspect of the paper which appealed to Mr. Gaster was as to whether photography was going to be a true representation of facts. He hoped they would be able to make it so, because it would be of the greatest importance to them as illuminating engineers. If, for instance, in factory lighting, they could satisfy the manufacturers by means of photographs that the methods they were employing in artificial lighting were giving the same conditions and shadows as by daylight illumination, there would be no trouble at all with the workers. The reply was in the hands of Mr. Mackinney, who said they could not, as lighting engineers, get away from the extreme value of photography. He did not want to say that they could not depict scenes which were untrue; but he did want to lay stress on the fact that an honest worker could put before people a strict representation of what they could see in an actual state. He believed that both direct and indirect lighting had their uses; and he also believed that semi-indirect lighting was a very happy medium. They had, of course, to look at these things from the broad standpoint. Mr. Dow and himself had not had the time needful to touch fully on the numerous variations in shadow effects which could be obtained from a direct system by having a large source instead of point ones, and also by having multiple direct sources. In regard to shadow density with the direct and the indirect systems of illumination, they had with the latter a gradual fading away of the shade which was extremely useful for various classes of service.

WOODEN AND IRON WATER-PIPES.

A short time ago, there was some interesting correspondence in "The Times" on the subject of old wooden water-pipes. It began with a letter from a correspondent who had noticed that in Oxford Street a number of hollow tree trunks had been dug up. The first letter was followed by a number of others, in which a good deal of information was given about these pipes. Some further particulars have lately been furnished to the writer of an article on the subject, bearing the initials "H. T. W.," in the "Journal of the Royal Society of Arts," by Mr. W. B. Bryan, M.Inst.C.E., the Chief Engineer of the Metropolitan Water Board. Mr. Bryan thinks it is almost impossible to say when cast-iron pipes were first used on a considerable scale for water-works purposes, but he is satisfied that it was very early in the Nineteenth Century. The East London Water Company commenced to use these pipes immediately after the incorporation of the Company in 1808. The Company had taken over the West Ham and Shadwell works, and the Companies owning them supplied all their water, as far as Mr. Bryan has been able to ascertain, through wooden pipes. But the East London Water Company laid down nothing but iron from the year 1808. The New River Company commenced to use cast-iron pipes about the same time. Up to then they did not profess to serve above the ground-floor level of the houses, because their pipes were of wood. But after that date iron pipes were used, and in the year 1816 the iron mains were charged regularly throughout the night; and great benefits arose by reason of the substitution of iron for wood. The higher pressures to which water was pumped by the engines of the East London Company in 1807 and 1808, and about the same time by the New River and other companies, necessitated the abolition of the wooden pipes, and Mr. Bryan thinks that for more than eighty years past the use of such pipes has been discontinued for the conveyance of water under pressure in London. "H. T. W." says it may be taken as practically certain that the old wooden pipes now occasionally dug up in various parts of London were left *in situ*, and became "dead," as soon as the connection to the new iron pipe had been made.

SULPHATE MANUFACTURERS IN CONFERENCE.

The International Meeting at the National Gas Exhibition.

As briefly announced in the "JOURNAL" for the 28th ult. (p. 354), the International Meeting of Sulphate of Ammonia Manufacturers was held on the previous Thursday at the National Gas Exhibition, Shepherd's Bush, under the presidency of Sir CORBET WOODALL, D.Sc., M.Inst.C.E. Among those present were Mr. T. Milne, the Chairman of the Sulphate of Ammonia Committee, Mr. Charles Carpenter, D.Sc., Mr. W. N. M'Ilravy, from the United States, and Herr E. Sohn, M. Lévy, and Mr. W. Kirkpatrick, representing respectively the German, French, and Belgian propaganda bodies. Mr. A. Koning was in attendance on behalf of the Belgians; and there were present a number of British representatives of the gas industry. We have received a print of the full report of the proceedings issued by the Committee, and from it the following abstract has been prepared.

The CHAIRMAN, in opening the proceedings, said his first pleasant duty was to offer a welcome to those who were attending the meeting, especially their friends from America and the Continent. He remarked that the Society had only had fifteen years' experience, during which time the record of its progress was eminently satisfactory, and entirely justified the formation of the Committee. It was formed in 1898, with a membership of 130 and a tonnage of 107,000; whereas the present membership was 424, with a tonnage of 275,000. The income in 1898 was £2682, and it was now £10,230. After these introductory remarks, Sir Corbet proceeded as follows:

The most striking thing to my mind with regard to sulphate of ammonia is the enormous increase that has taken place in production during the last ten years. Mr. Milne has been good enough to take out for me the figures (in tons) of the principal countries for the years 1900 and 1912:

	Great Britain.	Germany.	U.S.A.	France.	Belgium and Holland.
1900	213,000	125,000	20,000	37,000	33,000
1912	388,000	492,000	165,000	69,000	50,000

making a total of 428,000 tons for 1900, compared with 1,164,000 tons for 1912. I think figures like these show the absolute necessity of centralization and agreement between producers, so that there shall not be such a flooding of markets as would be detrimental to producers.

As against the increase in production, the increase in consumption is as follows (in tons):

	Great Britain.	Germany.	U.S.A.	France.	Belgium and Holland.
1900	68,000	126,000	36,000	49,000	25,000
1912	101,000	425,000	210,000	90,000	53,000

or a growth from 304,000 to 879,000 tons. In other words, production has increased very slightly under three times, while consumption has grown almost the same.

An estimate has been made of the world's production twelve years ago as compared with 1912. The production in 1900 was 525,000 tons; in 1912 it had grown to 1,495,000 tons. Against this, the consumption in 1900 was 407,000 tons, which rose in 1912 to 1,158,000 tons. Figures of consumption are given as far as known, but much is used industrially that is unrecorded. Fortunately all nations do not make sulphate, and they help to absorb the difference between production and consumption in the countries of origin. Japan is, of course, a large consumer, and so are other countries. It is a fact that the quantities produced so largely exceed the demand in our own country, that agreement between the producers in the various countries of Europe is necessary.

One interesting fact showing the value of the work of the Committee is to found in this: In 1897 the value of sulphate was 7s. 10d. per unit, with nitrate of soda at 10s. 2d. per unit; whereas in 1912 sulphate was 14s. 3d. per unit, with nitrate at 14s. 7d. per unit. Some way in between the two figures, the unit value of sulphate was above that of nitrate. Another way in which the Committee, at any rate in Great Britain, have done extremely good work is by the means undertaken by which the farmers have demonstrated to them that cultivating plots with sulphate is good economy. In 1910 the Committee had 673 plots established, while this year there were close upon 3000. I cannot see any better way of serving our own interests as producers of sulphate, and at the same time of doing good service to the country, than by the dissemination of knowledge in this way. A farmer is proverbially a slow man to take up new things; but he has a pretty accurate notion of what is good when he sees such results produced on his own farm or those of his neighbours. I can only say I hope the work of the Committee will continue to produce equally good results in the future as it has in the past.

REMARKS BY THE CHAIRMAN OF THE SULPHATE OF AMMONIA COMMITTEE.

Mr. THOMAS MILNE was then called on by the Chairman to make a statement for the Sulphate of Ammonia Committee. He began by expressing the thanks of the meeting to Sir Corbet Woodall for assisting the Conference by his presence, and his own thanks to the visitors from over the seas. He then complied with the Chairman's request, and in the course of his remarks said:

I am very pleased indeed to be able to tell you that the Sulphate Committee is more alive to-day than ever it has been; and I am convinced that it is doing better work than ever it did. The members of the Committee show the very liveliest interest in its work and in its meetings, and each one does missionary work in his particular district or among his professional friends in trying to obtain new subscribers, and also in spreading our literature, &c. The London office is very active in striving to obtain new subscribers from all parts of the kingdom—that is, both from among old-established makers, some of whom are most difficult to convince, and from more recently erected coke-ovens, the owners of which, I am glad to say, very generally recognize the good work that we are doing, and are willing to join and also appreciate the information which we are willing and able to give them. I am very proud of the fact that it has almost become a matter of honour among the members of our Executive Committee that each one should do his very best to bring in adherents; and very successful they have been, and I am sure will continue to be.

I said just now that the Sulphate Committee is very much alive. To prove this let me give a few figures: In 1898, the Committee was started by 130 subscribers (107,000 tons). In the next three years to 1901, 10 extra subscribers were secured; to 1904, 40 extra; to 1907, 66 extra; to 1910, 49 extra; and to 1913, 129 extra, with the largest additional tonnage we have ever had—viz., 62,000 tons. This now gives us 424 subscribers, with a total subscribing tonnage of about 275,000 tons out of a grand total for Great Britain and Ireland of (say) 388,000 tons. There is always thus an elusive quantity of about 100,000 tons that does not subscribe at all. Here is another point that shows that we are going ahead, in that the non-subscribing tonnage has been as great as 147,000 tons—that was in 1909—whereas now it is only 113,000 tons. I ask everyone here to give a helping hand to bring in the whole of this outstanding quantity. What, after all, is 9d. per million cubic feet of coal gas made, or 9d. per ton of sulphate that has a value of about £13 per ton? That is to say, the 9d. counts as nothing at all when compared to a fall of 5s. or 10s. or £1 a ton, owing to want of demand. It may be mentioned that some corporation and urban district council gas departments have in the past feared to join us, in case they might be surcharged the amount of their subscriptions; but it has been quite settled that money spent "for goods supplied and services rendered" is allowable.

We are just now spending 9d. per ton of sulphate from the subscribing tonnage—say, 70 per cent. of the whole (or 275,000 tons out of 388,000); and as I have said, the increase in the consumption in this country in the last two years has been 18,000 tons. In one year, in Germany, the increased consumption was as much as 75,000 tons—that was in 1910; and in the last three years the increased consumption in that country has been 150,000 tons; and they agree to spend up to 2s. 6d. per ton on all the Syndicate's production, or about £50,000 a year. It rather looks, therefore, as if according to the expenditure so is the result. When all makers join us, we shall do better work even than we do now.

Our very interesting field experiments do us a great deal of good. We began this work in 1910, when we had 673 plots. This year we have 2565 plots throughout England, Wales, and Ireland; and but for the death of the organizer in Scotland, we should have had a considerable number there as in other years. The use, or rather one of the uses, we make of this plot work is to send out leaflets in all directions very soon after the crops are reported upon—leaflets giving the comparative results for a particular set of crop experiments in a particular district, so that as many farmers as possible in the district know of the results that have been obtained by their own friends and neighbours. This adds particular interest to these leaflets.

I must say just a word on the subject of quality. A bad make is dear at any price. It contains too much moisture and acid and too little ammonia; and, as a result, there is often serious loss in weight at a distant destination, with bags quite ruined. This loss generally falls upon the receiver, and adds very considerably to the price that he has had to pay for the article. Owing to this, some prefer to import nitrate rather than sulphate. The point is that when consumption ceases to expand and real competition begins, troubles of all sorts will fall upon the maker of bad sulphate of ammonia. A good make should contain as nearly 25 per cent. of ammonia as possible, about 2½ per cent. of moisture, and not more than 0·5 per cent. of free acid. It is a perfect mystery why some makers who produce a good quality refuse to give a decently high guarantee, which in the future would be entirely to their own advantage. Seeing that the world's production of sulphate has increased from 525,000 tons in 1900 to 1,500,000 tons

in 1912, you will not be surprised to hear that I, for one, am an enthusiastic propagandist; and I want you all to be the same.

PAPER BY THE AMERICAN REPRESENTATIVE.

Mr. W. H. M'ILRAVY, of the American Coal Products Company of New York, then addressed the meeting at the request of the Chairman. He had brought a number of descriptive charts which were exhibited; and they showed with what care the paper he was about to read had been prepared. He divided his subject into two parts—first, a brief discussion of the fertilizer business in America in general, and of sulphate of ammonia in particular; secondly, what he called a progress report on the propaganda work on his side of the Atlantic. He reminded the audience of the great contrast between the area of the United States and that of the European countries with which they were concerned, and more particularly the contrast in density of population. If they would keep these differences in mind, together with their unavoidable consequences, they would find that they explained much that, from the point of view of European agriculture, seemed old-fashioned and unprogressive. With the idea of bringing out these differences, he had prepared a chart to show the relation of cultivated areas to total area and to population in European countries and in the United States. The chart showed that the total area of Great Britain, Germany, France, Austria-Hungary, Spain, Holland, and Belgium is 992,180 square miles, and the portion cultivated is 672,550 square miles; whereas the total area of the United States is 3,026,800 square miles, and only 746,012 square miles are cultivated. Thus the total area of these European countries together is less than one-third of that of the United States; but the cultivated area is nearly the same. In other words, only one-quarter of the United States is improved farm land, capable of receiving and profiting from an application of fertilizer; but two-thirds of the European countries are cultivated land. In point of population, the European countries already mentioned have nearly three times as many inhabitants as the United States, though occupying but one-third the area; and they carry from four to twenty times as many people per square mile. Thus to them intensive cultivation is something of a necessity. In the United States no such necessity exists.

The author proceeded to deal with the fertilizer consumption in the United States in 1912, the production of ammonia and the importation of nitrate of soda, and the use of mixed fertilizers. He gave an account of the agricultural experiments which had been carried out during the past three years, and produced the results of the tests on various crops. In conclusion, he said: We have for our field a rich and progressive country, impressive in area and in possibilities of development. As yet it has too small an agricultural population to afford the farm labour that is necessary to win the maximum return from commercial fertilizers. This is, however, a drawback that time is rapidly overcoming. With increased profits from commercial fertilizers will come increased use. Progress in this direction seems inevitable; but it may be a little slow. Like any husbandman, we who are engaged in propaganda work must till our field diligently if we would see it respond with an increased harvest. I think this is true not only of our own field in America, but of those in Europe also. From this point of view, we may say that the Sulphate of Ammonia Committee is our Farm Director; and we, each in his own country-side, are working our fields in accordance with the great general plan. Peoples and customs, like crops and soils, may differ; but if we plant in due season, and cultivate persistently, the return will be abundant. No one of us should hesitate to bear his fair share of the necessary outlay, lest he lay himself open to the reproach of reaping his harvest where others have sown.

STATEMENT BY THE GERMAN REPRESENTATIVE.

Mr. SOHN then addressed the meeting. He said that, as the representative of the Syndicate handling about one-third of the world's production of sulphate of ammonia, perhaps he might be allowed to give his audience, from a general point of view, his opinion as to the development of the market, and the measures necessary to maintain it in its recent good position. He did this at considerable length, and concluded as follows: From what I have said, you will have come to the conviction that it is absolutely necessary to try, by means of an extensive propaganda, to effect an increase in the manufacture of sulphate of ammonia which will move parallel with the continued very large increase in the manufacture. The measures necessary to effect this cannot be carried out unless all manufacturers of ammonia contribute an equal share to the total cost of the propaganda. But the raising of the money alone does not further matters very much. The principal thing will be the work which has to be done with it. In order to render the market steady to a certain extent, it might be useful to come to some agreement as regards general measures to be taken. Considering the present state of affairs in Great Britain, there seems to be a prospect of the efforts in this direction being crowned with an early success. I would, therefore, propose to you in the first place to thoroughly discuss the question among yourselves, when you will probably come to a similar understanding as regards conditions of sale as that which we on the Continent have already reached. In the meantime, it would be of even greater assistance to have a better and more reliable basis regarding selling conditions; and if something can be done in this direction, the general condition of the market would gain considerably in firmness. I would therefore propose that, until you yourselves have arrived at some understanding, those manufacturers who have agreed on a common propaganda should at least exchange among themselves statistical notes as regards manufacture, sale, and turnover. For this purpose, it would be necessary to authorize some firm in England to collect statistical material as regards that country, while on the Continent the work would be undertaken by my firm. An interchange of figures would then take place once a month. Secondly, it would be advisable jointly to lay down conditions as regards the quality of the goods intended for shipment abroad. I am of opinion that the consumption and sale can only be stimulated if the goods are delivered in a dry and faultless condition, and well packed. I will conclude my remarks by expressing the hope that one or the other of the proposals made will be adopted by you, or that they will at least have the effect of leading to some further consideration of the matter on the lines indicated.

FRENCH AND BELGIAN PROPAGANDA WORK.

M. LÉVY read a paper in which he gave particulars of the work of the Comptoir Français du Sulfate d'Ammoniaque, which was constituted on Jan. 1, 1908. It then included thirteen companies; now it comprises thirty, the selling operations of which it controls in France, Algeria, and Tunis. The propaganda is carried on principally by publications, competitions and exhibitions, and experimental fields. The Comptoir has published 31 different pamphlets referring to general cultivation in France and to either special cultivation or to some special districts or regions. About 800,000 copies of these pamphlets have been distributed in the principal agricultural districts of France, Algeria, and Tunis. Until the beginning of the present year, all the experiments carried out in France were directed from the headquarters of the Comptoir in Paris; but, in order to obtain more satisfactory results, and to allow of better supervision of the experimental fields, it was decided to decentralize the propaganda services, by the creation of a certain number of district offices, most of which are already in existence, and others will soon be established. These offices are: (1) Montpellier (for the Mediterranean region); (2) Lyons (for the South-East of France); (3) Bordeaux (for the South-West of France); (4) Angers (for Brittany and La Vendée); (5 and 6) the regions of the North, North-East, and Centre will continue to be directed by engineers resident in Paris. The propaganda in France will therefore comprise six district offices in 1914.

Mr. KIRKPATRICK, of the Belgian Syndicate and of the Semet-Solvay Coke-Oven Company, of Brussels, read a paper in which he said: Our object is simple—sell the whole production of sulphate of ammonia on the best possible terms, wherever it is made. As to the means to attain this object, they are also theoretically simple, but practically may be somewhat difficult to realize. We have to sell all quantities, produced in England, Germany, France, Belgium, Russia, America, or any other country; and so we must find a market for such quantities. If production increases, consumption must necessarily follow. The great facility of transport in our days makes any market accessible to all manufacturers; and if the production of one country exceeds the home consumption, export becomes compulsory and competition starts. It is to avoid such competition that Germany, France, and Belgium have come to an understanding, and have endeavoured by propaganda based on similar lines to develop consumption for their ever-increasing productions.

DISCUSSION.

The CHAIRMAN, in opening the question to general discussion, said he was sure he was voicing the feelings of the meeting in saying that they appreciated in the highest possible manner the thoroughness with which their friends from abroad had introduced the subject from their points of view. Anything more interesting he had never heard. He then directed attention to one or two points which occurred to him as being of special interest, and concluded by saying he thought the papers read had furnished very much to stimulate increased efforts for propaganda. He would endorse and emphasize the request of Mr. Milne to all those who produced sulphate in Great Britain and did not contribute to the propaganda work. They were not doing their duty. All should take their share.

Mr. CHARLES CARPENTER, called upon by the Chairman, said: I have very much pleasure in adding my tribute to what you have so eloquently expressed as to the great obligation we are under to our friends from the Continents of Europe and America. The statements which they have submitted throw very strong light on the remarkable methods which they adopt in the business of selling sulphate, as they do in all the businesses with which they are concerned. I would point out that we cannot expect to reap unless we sow; and, to some extent, the crop we reap depends upon the extent to which we sow. We cannot get away from the fact that the progress that has been made in America, Germany, Belgium, and other countries, is due to the fact that the makers of sulphate there are more liberal in their ideas as to what is necessary in the way of spending than we have been in Great Britain. We have heard this morning a figure mentioned of round about 2s. 6d. per ton being necessary for propaganda work, and you have heard of what results have been achieved thereby. I am very sorry indeed that the Company I represent is not to be called upon to pay 2s. 6d. per ton for sulphate of ammonia propaganda. We should pay with the very greatest of readiness and pleasure. I should like to include in my meed of praise, Mr. Milne, because I am quite sure that what Mr. Sohn has done for Germany, and Mr. M'Ilravy for America, would be done for us by Mr. Milne if he only had the sinews of war. I suggest that you try the experiment for a couple of years of putting 2s. 6d. per ton at his disposal,

and then judging by results. The money will be well invested; but unless you try you cannot know. You have a good object-lesson in the gas industry, which went to sleep for many years; but now it is alive to the importance of advertising and propaganda work. Cannot you apply the lesson to sulphate of ammonia also, which is found so important a factor in your economical gas production? With regard to the quality of sulphate produced, what Mr. Milne has mentioned I should like to emphasize. The Germans produce a uniform quality, which, when it goes abroad, gives satisfaction in every way. This is not true of British makes, and there are some makers who do not realize the seriousness of it. When it gets abroad, it gives sulphate a bad name, because it arrives in bad condition. The point may arise that, in the smaller works producing sulphate of ammonia, there is no knowledge of the standard required, nor perhaps the means of ascertaining what the standard is. My suggestion is that the Sulphate of Ammonia Committee should make it one of their duties to instruct works in different parts of the country. They might issue a circular to all works regarding the standard of sulphate to which they should work, as to the amount of moisture and of free acid. Information might be placed at the disposal of many producers throughout the country who are not in the same position as works which have chemical staffs of their own. With regard to storage, I am afraid I was brought up to consider as one of the proper ways of selling sulphate to sell it as it was made, without providing any storage. I was very much impressed with what Mr. Sohn said some three or four years ago with regard to the desirability of storing. He stated that the market is not always ready to receive what is made, and there ought to be adequate provision for storage, so as not to spoil a market by forcing stuff on to it when it is not ready to receive it. We have spent a good deal of money in storing sulphate; but we have got it back over and over again. Last year, when there was an endeavour to "bear" the price, I do not know what we should have done if we had been in the same position as we were before I heard Mr. Sohn speak. We should have had to get rid of our sulphate at prices considerably below what we did. These are practical facts, and I desire again to express my great indebtedness to Mr. Sohn and to the other gentlemen.

Mr. EDWARD ALLEN: I am very grateful for the invitation to your meeting given by Mr. Milne; it is another indication of his zeal in your cause. I am obliged to you, Sir Corbet, for this opportunity, as representative of the Institution of Gas Engineers, of expressing our great appreciation of the important work that is being done by your Committee. There is no doubt whatever that, if we are to sell gas cheaply, we must make the best possible market for products. Sulphate of ammonia has in past times varied so much in value, that, in preparing an estimate for a coming year, one hardly knew what to put down for it. Since your operations have been carried on so successfully, we have been able to rely upon something like a fixed amount; and I am glad to know that in my own case, as a rule, at the end of the year the returns have been better than the estimate. I have also the great pleasure to express, on behalf of the Institution, their appreciation of the interest taken in the work in Great Britain by our friends from the Continent and the States. Co-operation is certainly better than competition; and it is not only co-operation here, but international co-operation, that is required.

Mr. FYFE moved a vote of thanks to the foreign delegates.

Mr. D. MILNE WATSON, in seconding the motion, said the meeting was indebted to them for coming over so often. There was plenty of work to be done for several years ahead if the 2s. 6d. per ton subscription was to be got up.

Mr. CARR and Alderman PHILLIPS supported the motion.

On the invitation of the Chairman,

Mr. W. R. HERRING offered a few remarks. He said unfortunately the Committee's efforts had always been restricted for want of funds. He knew the trouble they had had when a proposal had been made to raise the subscription by 1d. or 2d. per ton; but this had not been on the part of the gas companies, but of those who were public servants, and had to look upon the matter perhaps differently from commercial men. He should be a very strong advocate of contributing 2s. 6d. per ton; but he was afraid that, if it were suggested, the little subscription now paid might be cut off.

The motion was carried by acclamation, and Mr. SOHN returned thanks.

On the motion of Mr. HERRING, seconded by Mr. E. A. HARMAN, a hearty vote of thanks was accorded to the Chairman.

Sir CORBET WOODALL, in acknowledging it, said he was always delighted to be of service to the gas industry (to which they owed so much) whenever opportunity offered.

USE OF MOTOR VEHICLES BY GAS COMPANIES.

By H. R. COOK, JUN., of the United Gas Improvement Company of Philadelphia.

[A Paper read before the Wisconsin Gas Association.]

This paper is intended to show the value of automobiles and motor trucks in the gas business. The data are taken from the records of twenty-three gas companies, and cover various types of automobiles and motor trucks. The costs given in Tables I. and II. cover only the actual operation of the machine—*i.e.*, tyres and repairs, gasoline oil, general repairs, licences, insurance, cleaning, and sundries. They exclude depreciation, interest, and labour.

OPERATION COSTS.

Table I. relates to automobiles used by managers, superintendents, and foremen; and Class A is a light runabout. All these were purchased during 1912, and the average operating cost is probably a little below what it will be during the life of the machines.

Class B also refers to a light runabout. One of the two cars of this class was purchased in 1910, the other in 1911. It is interesting to note that the average cost of operating in 1912 was less than the average for these cars since they were purchased.

Class C has to do with four cars of a slightly higher price than Class B. One is a touring car; the other three being runabouts—all having the same chassis. Two were purchased in 1910, one in 1911, and one in 1912.

Class D represents one runabout of approximately the same price as Class C, purchased in 1912. The costs covering this car are, therefore, somewhat below what may be expected in the future.

Class E tells the story of two cars, considerably more expensive than those of the previous classes. Both are touring cars, purchased in 1911. From the mileage thus far obtained, it is estimated that they have been in use for about half of their probable life.

Class F pertains to one four-passenger car, purchased in 1909, costing about the same as those in Class E. This car had an accident which made necessary extraordinary repairs, amounting to 1·2 c. per mile. It has been in use for almost its estimated life; and, by subtracting the 1·2 c. from the average cost of operation, to Jan. 1, 1913, we have a very fair figure of what may be expected of a car of this type.

Class G stands for a touring car of slightly higher price than those in Classes E and F. It was purchased in 1909, has been in use three-and-a-half years, and has practically covered its esti-

TABLE I.—*Light Motor Cars.*

Class.	Number.	Average First Cost.	Average Mileage, to Jan. 1, 1913.	Average Mileage, Year 1912.	Average Miles per Gallon, 1912.	Tyres and Tyre Repairs, Average Cost per Mile, 1912.	All other Operating Charges, Average Cost per Mile, 1912.	Total Average Cost per Mile, 1912.	Total Average Cost per Mile, to Jan. 1, 1913.
A	12	$615	4,446	4446	13·7	1·1	3·7	4·8	4·8
B	2	821	9,303	5594	12·6	0·4	5·6	6·0	6·4
C	4	908	14,323	7235	9·3	2·8	8·5	11·3	9·9
D	1	935	4,700	4700	8·4	0·3	3·8	4·1	4·1
E	2	1224	12,141	6885	9·5	2·7	11·8	14·5	11·4
F	1	1250	20,790	6034	14·9	4·9	9·0	13·9	14·1
G	1	1300	22,155	4684	10·4	3·2	12·2	15·4	10·5
H	8	1317	18,072	6658	10·1	2·6	10·0	12·6	10·6
I	2	1337	15,208	5705	9·6	2·7	9·0	11·7	8·6
J	1	1381	24,741	6223	10·0	1·8	10·1	11·9	9·9
K	7	1575	18,417	6718	10·1	2·6	7·2	9·8	8·7
L	1	1800	16,602	5638	7·3	1·9	6·3	8·2	8·9

TABLE II.—*Motor Trucks.*

A	4	$700	2000	2000	12·1	0·4	5·6	6·0	6·0
B	1	1000	2476	2476	6·4	—	6·7	6·7	6·7
C	1	1050	5034	5034	6·8	1·8	7·7	9·5	9·5
D	2	775	3194	3194	8·4	—	5·6	5 6	5·6
E	9	1380	2456	2456	6·8	0·5	7 0	7·5	7·5
F	1	2703	7336	7336	8·2	—	5·1	5·1	5·1
G	1	3000	6898	6378	4·1	2·4	10·7	13·1	13·1
H	1	3100	3479	3479	4·5	—	10·6	10·6	10 6
I	1	3154	1597	1597	2·6	—	10·2	10·2	10·2
J	1	3499	2577	2577	3·0	—	13·0	13·0	13·0

mated mileage. The cost for 1912 is considerably in excess of the average. Of this cost, 4·4 c. may be charged to a general overhauling.

Class H includes eight cars of about the same average cost as that of Class G. Six are roadsters and two are touring cars. One was purchased in 1908, one in 1909, five in 1910, and one in 1911. While the average cost of this class is not high, it is considerably higher for 1912 than the average to Jan. 1, 1913, due to the high cost of operating the old cars. This type of car was not satisfactory; for one car may make a good showing and another a very poor showing.

Class I is connected with two roadsters, one purchased in 1909 and the other in 1911. The older of these cars has been sold, after covering the mileage expected of it; the other is still in use. The cost of operating this class is considerably lower than the other classes; first cost also comparing favourably.

Class J relates to a roadster purchased in 1909, and not of as high a grade as may now be purchased for equal money. It has made almost its estimated mileage, and still shows a fair cost per mile.

Class K consists of considerably higher-priced cars than those of the other classes. Of these, there are seven—three touring cars and four roadsters. Three were purchased in 1909, three in 1910, and one in 1911. While older than most of the others, this class is expected to cover a greater mileage, and, up to Jan. 1, 1913, had made only about 60 per cent. of the rating. The operating cost is lower than that of any other class of about the same weight; but it will no doubt be increased somewhat by the time the cars reach their estimated mileage.

Class L refers to one car—the highest priced of any in the table. It is a roadster, purchased in 1909; and, though in its fifth season, it has made only about half the mileage expected of a car of this price. Its operating cost is low, and is not increasing. In fact, the year 1912 was below the average.

A general analysis of the table shows the average cost of operating the smaller cars (as would be expected) to be lower than that of the heavier ones. A study of the individual cars shows that the cost of operation runs up as the car nears the end of its life; but in some cases, during the middle of its life, it is lower than at first.

The following is a brief description of the vehicles classed in Table II., all of which were purchased in 1912:

Classes A, B, and C are light delivery waggons, of 500, 750, and 1000 lbs. capacity, used for carrying Welsbach material, fittings, and small special appliances.

Classes D and E are light trucks, used for meter work, hauling store-room material, and for delivering ranges, &c.

Classes F, G, H, I, and J are heavier trucks, for hauling store-room material, delivering ranges and water heaters, and heavy pipe for mains.

Class F truck has an exceedingly low cost, partly due to its being used on very good roads, and it is somewhat lower than is expected for the future.

Class G has a high cost, largely due to hilly territory and poor roads. This truck is considered quite satisfactory, and several more have been recently purchased. Lower operating costs are expected in the future.

Operation Details.

It will be well to describe the general method of working with these delivery waggons and motor trucks. The driver and helper on heavy trucks, when used for delivering ranges, &c., do no work on the consumers' premises. The range is delivered and placed as near its permanent location as possible, with necessary pipe and a box of fittings. A fitter calls later and makes the connection; the truck then goes to collect the material left over. This means that the truck is idle a very small percentage of the time. The driver works from a route sheet, laid out by the despatcher, so as to cover the work with a minimum mileage. The light delivery waggons, when fixing meters, delivering Welsbach material, hanging fittings, &c., are idle while the driver does the necessary work, where the job does not take more than an hour. For longer jobs, a delivery is made, and the work done by a fitter, who travels on a bicycle or street car.

Experience shows that, with continued use of motor vehicles, an organization can be developed that will operate them with little expense; and where there are a number of cars, a man can be employed to make the minor repairs at much lower cost than repair shops.

Depreciation should be reckoned on an estimated mileage basis, and the figures per mile are approximately as follows:

	Cents.
Cars in Table I.	5
For trucks costing less than $1000	6
,, ,, $1000 but less than $1500	7
,, ,, $1500 ,, ,, $2500	8
,, ,, $2500 and above	9

These figures are based on experience covering a large number of machines, and they have been found correct for the average car or truck. For example, for a $1000 car, a run of 20,000 miles would be the estimated life. If the car is disposed of before covering this mileage, a scrap or trade-in value is usually obtained which balances the deficiency.

Comparison of Horse and Motor Service.

The tables do not include the labour of driver or helper—this expense not applying to motor vehicles more than to waggons, except that the wages of the driver may be slightly higher in the case of the former. To illustrate this, consider the following: A driver of a team or motor vehicle, when not engaged in driving, will be doing other work not chargeable to transportation. Where two or more men are carried, the driving may be regarded as the total wages of the men while the car is moving; and the greater the number of men carried, and the higher their wages, the larger is the labour cost per mile, and the greater the saving in labour by the more swiftly-moving vehicle. With a team making three miles per hour, and carrying two men, with total wages of 45c. per hour, the labour cost of transportation will be 15c. per mile. For a similar load hauled by a motor truck, averaging ten miles per hour, with two men, and total wages of 50c. per hour, the labour cost of transportation would be only 5c. per mile. This applies to the vehicles while in motion. With vehicles at rest, all charges cease, except interest and storage. With horse-drawn vehicles there are these charges, and those for the feed and care of the horse; this not being proportional to the mileage. This reasoning also applies when work is slack and there is no use for the vehicles, as the keeping of a horse is very expensive.

Detailed comparisons were made by the author of horse-drawn and motor-driven vehicles of various capacities; the estimates being applicable only to the local conditions to which they refer. The first is a comparison between a light runabout (Class A, Table I.) and a horse and buggy for a foreman or inspector; the second, between a light delivery truck (Class D, Table II.) and a one-horse waggon; the third between a light delivery waggon (Class A, Table II.) and a two-horse waggon; the fourth, between a heavier delivery waggon (Class C, Table II.) and a two-horse waggon; the fifth, between a one-ton truck (Class E, Table II.), and a two-horse waggon; the sixth, between a two-ton truck (Class H, Table II.) and a two-horse truck. With a single exception, the tables show an estimated operating cost in excess of the actual, and all show the motor vehicles displacing but one horse-drawn vehicle. But, owing to the greater speed, the motor vehicle in most cases displaces more than one-horse drawn vehicle. The following are summaries of the tables:—

	Horse Haulage.	Motor.	Saving by Motor.
Light runabout for foreman and inspector	$684·50	$464·50	$220·00
Light delivery motor truck	649·00	505·81	143·19
Light delivery waggon	1,110·50	721·00	389·50
1000-lb. capacity delivery waggon	1,110·50	819·00	291·50
One-ton capacity motor truck	1,394·00	735·00	659·00
Two-ton capacity motor truck	1,519·00	1,398·75	120·25

Advantages of Motor Vehicles.

There are a number of factors which lean favourably towards the use of motor vehicles by gas companies; and their value cannot possibly be measured in dollars and cents. In conclusion, I will dwell briefly on a few of them: Promptness in making deliveries, due to the speed of the motor vehicle, results in pleased and satisfied customers—the aim of all gas companies. For greater efficiency in supervising distribution work, the motor-cycle is the cheapest and quickest, when weather conditions are favourable; but when roads are bad, from rain or snow, it is dangerous. A light runabout is not affected to any great extent by these conditions, and appears to be the ideal means of transportation, allowing a foreman or superintendent to keep in close touch with the work. Its value is more apparent in scattered territories, where it also permits of the carrying of tools and light materials needed in a hurry. Our experience has been that there has been a decided saving by using motor vehicles; and we are purchasing more of them.

In the discussion upon the paper,

Mr. J. A. Patten said he had a one-ton truck operated by a fitter; and in a year it cost twice as much as the ordinary single horse and waggon. In another place, however, the same make of truck replaced four single waggons and did more work. He believed the man who ran the machine had much to do with the success of auto-trucking. Where the truck took the place of four waggons, the man thoroughly understood its operation.

Mr. W. Jones said he had a ¾-ton truck now in its third year. Their longest period of enforced idleness was for two weeks, during a severe snowstorm. Just before the busy season they overhauled, repainted, and varnished it. They were fortunate in getting the right man; and he took an interest in the truck, keeping it in good shape. The motor truck sufficed for the fitters, service, and main crews, and all the freight from the railway depôts. If they could retain the present operator, the machine would be good for ten or twelve years. Should they invest in another, they would get a heavier one. But they were more than pleased with their experience with the truck.

The President (Mr. I. F. Wortendyke, of Janesville), asked the author what was the effect of the increasing cost of gasoline.

Mr. Cook replied that with a heavy truck they would get approximately ten miles to the gallon, so that if gasoline went up 10 c. the cost of operation increased 1 c. per mile. He believed they could use bye-products from the gas plants to run their machines.

Mr. A. J. Brechtel (of the General Vehicle Company) pointed out that no tyre or upkeep expense was shown in certain of the tables.

Mr. Cook said he had given the particulars as collected. The trucks purchased last year had solid tyres. The estimates of

cost per mile were higher than the actual cost, so that there was ample allowance for the repair of tyres.

Mr. BRECHTEL said his Company had in service in Minneapolis three machines which had covered between 28,000 and 31,000 miles on one set of tyres. At the same time, he did not think it right to omit to charge for wear and tear on tyres. Solid tyres were guaranteed for twelve months; and it was right to reckon for a new set of tyres every year to arrive at the cost of working. His trucks were all electric driven. The tyre manufacturers gave eighteen months' guarantee on electric, and twelve months' on gas cars, because their speed was uniform, and governed by the motor battery. The St. Paul Gas Company bought a one-ton truck last year. It had covered more than 6000 miles, at a total expense (beyond current) of 80 c., allowing nothing for tyres or renewals. It had an Edison "A 6" battery, on which was guaranteed a four-year life with 100 per cent. efficiency. On a lead plate battery, in a single-ton machine, they reckoned on a renewal every 12,000 miles, or about 300 cycles charge and discharge of the battery, figuring 45 to 50 miles per charge. Users of cars, pleasure as well as commercial, were in the habit of charging the batteries very frequently. The life of a battery was measured by the cycles it made; and it was policy, in driving electric vehicles, to get 80 per cent. of the battery capacity, and then recharge. More batteries were ruined by too frequent charging than in any other way. His Company had sold a 3½-ton truck on which battery renewal cost was $327, making from eight to twelve miles a day. He found the operator was charging the battery every night, with the result that it was shot to pieces. Another machine which had been in service ten years was getting 24 to 28 months' life, because it was charged only two or three times a week.

REFRACTORY MATERIALS.

ON Friday evening, at the Westminster Technical Institute, Vincent Square, Dr. RUDOLF LESSING delivered the last of a series of three lectures on "Refractory Materials" which had been arranged by the London and Southern District Junior Gas Association, in conjunction with the London County Council. The lecture and demonstrations were keenly followed; and at the close Dr. Lessing was accorded a hearty vote of thanks, on the proposition of Mr. S. A. Carpenter (the President of the Association), seconded by Mr. Ernest Scears (the Secretary).

During the earlier portion of his remarks, the lecturer was engaged in an experiment to show the casting of clay—a "green" mixture, with grog in it, tempered to a definite amount of moisture. In this particular case there was 14·9 per cent. of water in the mixture, which was plastic—that was to say, it retained any shape that might be given it. In the process of liquefaction, the idea, he said, is to alter the plasticity, or rather to alter the colloidal character, of the clay. The colloidal, he stated, is a physical state of matter which is the opposite of crystalline. Substances like gelatine, glue, and things which possess similar properties, are colloidal—they do not form crystals. Now the clay substance itself is of a similar character, and is also non-crystalline; and according to the recognized theory, the plasticity of clay is practically due to the fact of it being in this state. This process of the liquefaction of clays, which was discovered by Weber not so very long ago (there are other processes working on similar lines, and practically based on the same principles), is intended to loosen the structure, and remove the plasticity of the clay. After the mixture is tempered, a certain chemical is used which has as the basis alkalis; and in order to make it work, these alkalis are combined with very highly plastic clays, or with acids extracted from the ordinary humus, which also have the property of altering this state of plasticity. The amount of alkali that is put in is almost negligible, as regards the fluxing of the goods made from it afterwards. That is to say, there is no more than a fraction of 1 per cent. put in, which cannot have any marked influence.

Having applied to his sample of clay the chemical powder referred to, Dr. Lessing tried to work it so that every bit of clay should obtain its share of the liquefying substance, as the success of the experiment was dependent upon a thorough mixing. Of course, no water was added; but very soon the clay was seen to work much easier. When the process is carried out on a large scale, he remarked, this mixing is done by machinery. At first, in a machine very much on the lines of the ordinary clay pug mill; and when it gets to a more fluid stage, it is placed in a cylindrical agitator, fitted with moving arms inside. There is a very simple and ingenious means of ascertaining the progress of the liquefaction, because if the machine is driven by an electric motor, all that is needed is to provide an ammeter and read off the current used. As the mixture liquefies, the current used in driving the machine decreases. By this time the sample was in a semi-liquid state; and the lecturer continued his remarks on the subject of casting. Instead, he said, of using wooden moulds, as in the ordinary practice, the best material for clay moulds is plaster of paris, or any porous material. The beauty of this process, where it can be applied, is that the mixture being in a more or less liquid form, adapts itself to the shape, and even to the texture, of the mould in which it is cast, so that it is possible to get exactly the outside texture that is required. At this stage, the sample was almost in a running condition; and after a few more minutes it was ready for use. Dr. Lessing then placed it in two moulds he had made himself. One of these was a medallion; this being chosen to show how well and easily the mixture adapts itself to even the finest lines of the mould. By the end of the lecture the clay was sufficiently set for removal from the moulds.

Proceeding, he explained that for the use of plaster of paris as a mould there is a two-fold reason. Firstly, it is a porous material, and as soon as the running mixture is poured in a good deal of the water is straight away absorbed, so that it assists drying. Besides this, plaster of paris acts in the opposite direction to the liquefying chemical that is put in, and tends to coagulate the fluid again. As soon as the mixture touches the plaster of paris, it covers itself with a film of more or less leathery nature—quite dry clay, which has a tendency to solidify. Though he hoped to remove his samples from the moulds at the close of the lecture, on a large scale it would take very much longer, and might be a matter of a week or two before big pieces would be dry. As a rule, however, they can be taken out of the mould, on account of the hard section that forms outside, after a period of from 24 to 48 hours.

The lecturer then turned to the question of the testing of clays and refractory goods. With regard to the testing of clays, many of the methods he would have to describe would cover both the unburnt clay or green mixtures (the term "green" simply means unburnt) and the burnt goods. In the green clay there is a certain amount of combustible matter, which is removed by igniting it; and there is also the water of combination, which is driven off by heating. Otherwise the mineral residue of the clays is the same, and therefore the tests are the same. One of the most important points in regard to testing is, of course, the analysis; and the quantitative analysis of clays is a very intricate job. It is exceedingly difficult; and only a skilful and experienced man can hope to get results worth considering. Early workers secured some wonderful results; but it is only quite lately that the refinements of the process have been brought into play. The analysis is directed to find the principal ingredients of the clay—whether silica, alumina, iron, titanium, lime, magnesia, potassium, or sodium. The process which divides the substance into its elements is termed the "ultimate" analysis.

There is another kind of analysis which, with regard to clays, has been applied from time to time with a fair measure of success, and sometimes of failure. This is the "rational" analysis, as against the ultimate analysis. This rational analysis does not intend to find out the smallest particles composing the clay, but to decompose it into the main groups of substances which go to make up the combination of clay. It determines the (1) clay substance, (2) felspathic detritus, and (3) quartz *débris*. The method consists of treating the clay with sulphuric acid of certain strength, which decomposes the clay substance, and leaves the other two components intact. Subsequently means are taken to drive off the quartz in a volatile condition, and only the felspar remains. Thus are indicated the ratio of the three substances, and hence the term rational analysis. There are in the process various pitfalls, so that it requires to be carried out by very experienced men to yield satisfactory results. Indeed, there are certain clays which will not give satisfactory results under any conditions, though these are exceptions. It is a highly interesting operation; but for refractory material practice it is not of the same importance as, for instance, to the manufacturer of china or earthenware, where a certain percentage of felspar has to be added, and therefore it is necessary to know how much there is already in the substance. Of course, fired goods are not amenable to rational analysis, because the nature of the clay substance itself is entirely altered through the loss of water.

Possibly one might classify under the term rational analysis the attempts made from time to time to determine the approximate composition of refractory goods. That is to say, for instance, the separation of a fire-clay retort into its original components, to determine the materials that have been used. For the user of refractory goods it is exceedingly important to know about the physical behaviour of the goods; and in the first instance there is the refractoriness. Of course, the refractoriness, or resistance to fusion or softening, determines whether a certain article deserves the description of refractory at all. The refractoriness is determined in a similar manner to the melting-point. Clays, however, do not melt in the ordinary sense, but go through a stage of softening; and therefore there is not the sharp melting-point there would be in the case of chemical compounds of definite composition. Some slides were then thrown on the screen, showing the textures of various bricks, retorts, and so on; and the lecturer remarked that from their appearance it would be seen that chemical analysis cannot possibly tell one everything about certain goods.

The test for refractoriness, he explained, is made by forming the clay into the shape of a cone, or, if it is a brick, pieces are chipped off and ground down as nearly as possible to the same shape. Alternatively, a very fine powder is made; and this, with the aid of gum or other sticky substance, which will burn out, is also formed into a little cone. These test cones are then put, along with a number of Seger cones, corresponding to the temperature at which one assumes the brick will fuse, into a furnace capable of being raised to the requisite temperature. The recognized lower limit of refractoriness is a softening-point corresponding to Seger cone No. 28—1630° C., or 2966° Fahr. Anything below this temperature would not be considered refractory; and material softening immediately above this limit would not be of a very high class. Slides of furnaces used for the purpose were then

thrown on the screen; and for the benefit of those who did not attend the lecture, it may be pointed out that illustrations of some of these appliances appeared in the "JOURNAL" for Dec. 20, 1910 (p. 842). The furnaces may be gas-fired, where a high-pressure supply is available.

Another method, not developed so highly yet, but which, for practical purposes, is more important than the ordinary fusion plan, is the testing of bricks under load. A picture was shown of a furnace used in America by the Government Investigation Department for clays. It is fired by natural gas. The brick is raised in temperature, and a definite load is put on it; and the temperature at which it collapses is taken by a pyrometer. Photographs of bricks tested in this way were shown.

There is a limit to what a brick will stand, and beyond which it will fuse; but long before the refractory material reaches this point there may be properties which come into play that make it either unfit or unsuitable for certain purposes—chiefly the contraction of the brick. A brick or retort should be fired to such an extent, and for such a time, that it comes to the end of its shrinkage. Most bricks have a certain amount—though it may be a very insignificant one—of residual contraction left in them. It is not always possible to get it all out. In certain cases a point may be reached at which the brick will commence to expand; but this is rare. On heating, silica material expands; but there, again, one ought to go up to a sufficiently high temperature in firing to take all the expansion out. Silica bricks do, however, suffer to some extent from the complaint of having a certain amount of residual expansion left in them. The test for contraction and expansion is comparatively simple. Dr. Lessing then described the one adopted by the Refractory Materials Committee.

Proceeding, he said that another physical property to which attention must be given is the porosity. On firing the clay, and getting rid of the water of combination, a certain proportion of hollow spaces are left throughout the mass, though the proportion differs with different clays and varying mixtures. One governing factor which determines the amount of porosity that a brick has is the amount and character of grog that has been put in in the first instance. If broken-up material, like brick or saggars, is put in, this, having been fired before, is porous; and the mixture would show porosity equivalent to the air-spaces in the grog itself, and the air-spaces between the grog and the clay, where the two are not combined very intimately. It is necessary to find the ratio of the air-spaces to the total volume. The method adopted by the author for this purpose was then described, and a photograph of the apparatus employed was shown. An account of the operation and an illustration of the apparatus will be found in the number of the "JOURNAL" already referred to.

One other physical property which is of some importance, the lecturer went on to say, is the conductivity of heat. It is most desirable that a gas-retort should have a high thermal conductivity—that is to say, it should allow the heat to travel quickly through its walls. Generally, one might say that the conductivity is in inverse ratio to the porosity. Some persons think that air-holes in a retort would allow the heat to travel; but it is not so. The carrying out of experiments for ascertaining conductivity is not very easy. It is mostly done by inserting thermo-couples at certain distances apart in one particular brick, and measuring the time that it takes for the instruments to assume the same temperature from heat applied at one point.

Before closing, Dr. Lessing remarked that he would like to lay stress on the point of "slagging." Flue dust carried along with the gases from the combustion chamber, settling on a retort, will act as an initial flux; and in many cases the failure of a retort is to be attributed, not to the material of which the retort is made, or the manner in which it is made, but to the fact that the retort has been subjected, not to a clean gas, but to substances which act practically as poisons to it. For a practical man using fire-clay goods, it should be a golden rule always to endeavour to prevent any fluxing materials from impinging on these goods while they are exposed to a high temperature. The crushing strength of fire-bricks is ascertained in the same way as with other building materials. It may vary to a very great degree, depending on the amount of intimate binding that the brick has gone through. Though the lower limit of crushing strength has been fixed by the standard specification at 1800 lbs. per square inch, there are quite a number of bricks that have a much higher strength, and go up possibly to 4000 lbs. per square inch. One has to accept porosity in a retort; but the more porous a retort is, the more permeable will it be to gases—both to coal gas leaking out and combustion gases passing into the retort. The retort manufacturer should use all his skill and endeavours to try and make a retort which will not allow of this happening. Three slides were then shown, for the purpose of depicting what a retort-setting should not be like.

In concluding his lecture, Dr. Lessing said: I have practically gone through the standard specification in detailing the tests that have to be applied to the material. As far as it goes, it is an excellent thing. It is good for the makers of refractory goods, and it enables gas engineers to have a certain control over the deliveries they get from the makers. It has never been attempted that this specification should set up any rules in the manufacturing department. The only rule expressed is that, in the manufacture of gas-retorts, the fine dust of grog that will pass a sieve having 16 meshes to the linear inch should be removed from the grog before it is mixed with the green clay. The reason of this is that the fine dust of burnt brick has no binding power, and will simply hinder the green clay, which should be in a very fine condition, from combining with the granular grog. In all other respects, the manufacturer is given full liberty to work as he pleases, so long as he produces a result that will comply with the tests that the standard specification imposes upon the goods. These tests, again, should not be taken as the upper limits of good quality; but they are fair limits, and in most cases are set in a tentative way on the low side, so as to make it easy to bring the manufacturer up to date by a gradual process of improvement and evolution. There are certain points in the specification which might be criticized. One is the question of porosity. It must not be assumed that a high degree of porosity is necessary in a retort. The test is simply taken as an indication of the presence of a sufficiency of grog of a fair size. If one could make a mixture with the same property—that is, containing enough grog of a sufficiently large size, which forms the skeleton, to allow a retort to withstand rapid and frequent changes of temperature—without having as a corollary a high degree of porosity, it would be all the better. So far this has not been done; but by better working methods one should get nearer to it.

After the lecture, some time was spent in an examination of the excellent display of clays, bricks, &c., which Dr. Lessing had arranged in the room.

LIQUID PURIFICATION OF COAL GAS.

In one of the papers at the annual meeting of the American Gas Institute, Mr. JAMES G. O'NEILL, of Geneva (N.Y.), brought before the members his process for the continuous purification of coal gas by weak ammoniacal liquor. As the process was fully described and illustrated in the "JOURNAL" for Oct. 29, 1912 (p. 373), it is only necessary now to reproduce the concluding portion of the paper, in which Mr. O'Neill gives some particulars as to the cost of working.

After purifying 600 million cubic feet of gas by the process, the cost of purification per 1000 cubic feet is given as follows: Labour, 0·05c.; oxide, 0·10c.; steam, 0·10c.—total, 0·25c. This cost of one-quarter of a cent per 1000 cubic feet is for coal gas containing on an average 600 grains of hydrogen sulphide per 100 cubic feet, which, of course, is not fair to the new process when comparing it with the cost of the ordinary oxide purification based on 400 grains of hydrogen sulphide per 100 cubic feet. Operating the process does not in any way increase the labour in concentrating ammonia.

To show what the new process really means, assume, for example, a plant manufacturing a million cubic feet of gas per day. The cost of three purifying boxes of the capacity which would be necessary for oxide purification alone would be about $14,000. Instead of installing three boxes, this process permits us to instal two small ones; their combined capacity being equal to one-third the ordinary necessary oxide capacity. By using two small boxes, we are in a position to change the oxide in one and still deliver clean gas; also to keep a better check on the condition of the gas going through the purifiers. The cost of these two boxes, with a cooler and its connection for the wash liquor, is very close to one-half the cost of the regular oxide purifying installation, or $7000. Therefore, our total annual saving in purifying gas for this size of coal gas plant is as follows:

Interest, taxes, and depreciation on $7000, at 12 per cent.	$840
Saving of 1c. per 1000 cubic feet on purification of gas containing 600 grains of hydrogen sulphide per 100 feet . .	3650
Total annual saving	$4490

In addition to this advantage of cheaper operation, we are almost entirely eliminating the troublesome element of labour, are free to use any grade of coal which we can purchase to advantage, and, so far as purification is concerned, we can supply any market for gas, no matter how variable its demands may be. The process gives us a clean, small plant of enormous purifying capacity, and at no time dangerous to life or property.

In the gas industry, as in all other industries, the future will demand of us cheaper, safer, and more elastic methods of producing gas. The new method of purification which I have devised is one of the steps towards the attainment of this end.

Junior Institution of Engineers.—In a paper read before this Institution on Monday last week, Mr. Ernest King dealt with "The Institution and its Work." He traced the progress made since the foundation of the Institution 29 years ago by a few young engineers serving in the shop of Messrs. Maudsley, Son, and Field, some of whom are still members. He referred to the value, in the general education of the engineer, of the visits to works, which took place every month, and, when possible, had a bearing on the subject of the monthly paper, and alluded to the Friday evening informal meetings as being helpful to those who desired to extend their knowledge on any particular subject. Mr. King touched upon the good work done by the benevolent fund, the value of the Engineers' Register, designed to enable members who are out of employment to find situations, and the advantage of social functions.

BEHAVIOUR OF WATER IN GASHOLDER CUPS AND TANKS.

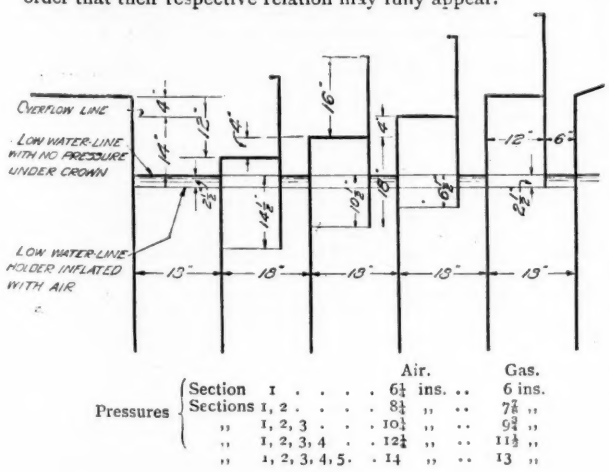
By HERBERT W. ALRICH, Assistant Engineer of Construction of the Consolidated Gas Company of New York.

[A Paper Submitted to the American Gas Institute.]

In his introductory remarks, the author endorses the work of Mr. F. Southwell Cripps and others on the subject of gasholder cups; but while concurring in their statements of theory, he dissents from some of their assumptions and recommendations. Further, he points out that they have confined their discussions solely to the efficiency of the cup as a hydraulic seal, when it must now be required to perform this essential function under the restriction that the oil accumulated on the surface of the tank water inside the holder shall not be permitted to pass through the cup to the surface of the outer tank water. All cups designed to the proportions recommended by the previous writers are, he says, equally efficient as seals and as pumps for withdrawing oil from the tank water interior to the holder. This pump action is not an essential feature of an efficient seal. It is unnecessary and avoidable. However, the previous writers direct attention to certain features necessary to proper cup action which are commonly disregarded without adequate reason. The purpose of the writer is to discuss cups designed to retain the oil within the interior of the holder; and this he does as follows.

While the principles governing cup design are independent of the size and pressures of the holder, some of the proportions must be accommodated, within limits, to certain specifications of each particular holder. Great accuracy in determining these proportions is unnecessary—in fact, it is the belief of the writer that three variations of one cup design would satisfy all the requirements of the whole of the holders in the United States. However, in anticipation of inquiry, he will state that, while he has had experience with numerous holders some of which were small, his observations and studies have been made principally in connection with those having capacities of 3, 5, 10, and 15 million cubic feet.

When a holder is being prepared for service, it is the usual practice in America to bring the water up to a level at a distance below the overflow line equal to the maximum pressure with gas. However, the holder is first inflated with air, under which condition the full weight of the sections is acting upon the tank water; giving a pressure exceeding the gas pressure by as much as 1¼ inches. As the holder rises, the level of the tank water falls, inside the holder actually, and outside relatively—as a consequence of water being withdrawn from the tank by the ascending cups, and also the diminishing displacement of the tank water by submerged metal. The first of these increments may amount to 1 inch, and the second to 1⅛ inches. As their sum will always exceed the difference between air and gas pressures, no water can be lost by filling a tank to such an assumed line. Extreme accuracy in locating the low-water level when filling a tank is not recommended here. But, as the influence of these factors is to be considered in the discussion, they are introduced at this point in order that their respective relation may fully appear.



		Air.		Gas.
Pressures	Section 1	6¼ ins.	..	6 ins.
	Sections 1, 2	8¼ ,,	..	7⅞ ,,
	,, 1, 2, 3	10½ ,,	..	9⅞ ,,
	,, 1, 2, 3, 4	12¾ ,,	..	11⅛ ,,
	,, 1, 2, 3, 4, 5	14 ,,	..	13 ,,

Fig. 1.

There is yet another increment of depression of the tank-water level which is the result of displacement of the water by the weight of the inflated holder. While the actual displacement of water occurs within the holder only, the water level exterior to the shell is depressed relatively by exactly the same amount. This increment is usually regarded as negligible, and properly so, for its maximum probable amount is only ⅜ inch, and it is more frequently but ¼ inch. It is mentioned here in connection with the foregoing depressions in order that it may be fully demonstrated that when a holder is inflated, if the exterior tank-water level is at the overflow line, the tank must contain more water than it is customary to provide at the first filling. Throughout this discussion, it will be assumed that the tank contains this larger quantity of water.

Fig. 1 is a conventional representation of the five lifts of a holder in their relation to the tank-water line when the sections are at rest upon the landing beams, and before the holder has been inflated for the first time. The consideration of the volume of metal in the holder sections is not extended to the specific treatment of the cups and grips. As the resulting inaccuracy is negligible, they are assumed as consisting structurally merely of lines, with the exception of the bottoms of the cups. The proportions and conditions shown are typical of American practice; but the illustration does not purport to reproduce any particular holder. The tank water outside the inner section stands at the same level as the water inside, for as yet no pressure exists under the crown other than that of the atmosphere. Each grip encloses to its full capacity a volume of air which was entrapped when the water rose above the lip of each dip plate. The pressure within the grip corresponds to the distance from the surface of the tank water to the lower surface of the entrapped air. The pressures (in inches) within the grips for this phase are as follows:—

	Air.		Gas.
First section	6¼	..	6
First and second sections	8¼	..	7⅞
First, second, and third sections	10¼	..	9⅞
First, second, third, and fourth sections	12¾	..	11⅛
First, second, third, fourth, and fifth sections	14	..	13

As pressure develops under the crown, the exterior tank-water line and the pressure within the grip both rise by an amount corresponding substantially to the increase in pressure. When the lip of the cup of the inner lift is about to penetrate the air entrapped in its related grip, the conditions are as shown by fig. 2. The pressure of the first section being assumed as 6¼ inches, the pressure within the grip of the second lift is now 8½ inches.

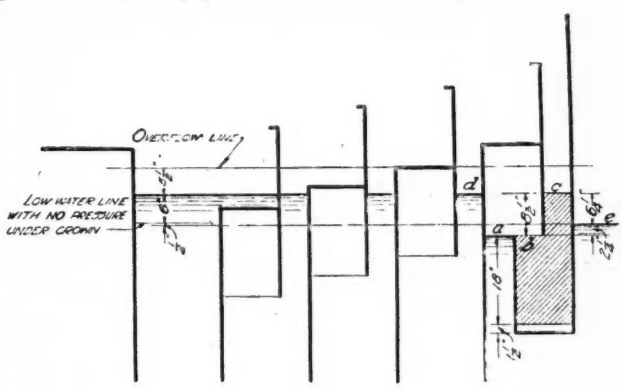


Fig. 2.

The lower surface of the entrapped air may now be regarded as being divided by the lip of the cup into two parts, *a* and *b*. Although still at a common level, this relation of *a* and *b* will soon be disturbed. But at this and all later stages of entrapment equilibrium will require the same pressure upon both segments of this bisected surface. Three water levels, *c*, *d*, and *e*, are factors of this equilibrium. Reference to fig. 2 will show that surface *a* is under pressure from a head of water of 8½ inches from *d* external to the section. This head is represented internally by the holder pressure of 6¼ inches acting upon surface *e*, *plus* the 2¼ inches head of water from *e* to *a*; the sum being 8½ inches as before. Surface *b* is likewise under a pressure of 8½ inches, which is the head of water from *c* to *b*. During all stages of this entrapment, the pressure within the grip will exceed the holder pressure by an amount of which the measure is the difference between levels *a* and *e*.

Before passing to the consideration of a succeeding phase, it may be noted that the ascending cup has entrapped the water indicated by the hatched area in fig. 2. Attention is directed to the fact that the quantity of water thus acquired for the seal is somewhat more than the cup could hold level full.

As the ascending lift advances beyond the position shown by fig. 2, the lip of the cup penetrates the entrapped air, which is now acted upon at the surface *b* by the water segregated in the rising cup. This conflict of water and air results in both being displaced by such amounts as are required by the inexorable law of equilibrium. Thus surface *a* is forced downward, while *b* is retarded in rising, and *c* is accelerated by the amount that *b* is hindered by the differences between levels *a* and *d* (fig. 3) and *b* and *c*, and the difference between *a* and *e plus* the holder pressure, all being at every instant equal. This behaviour continues until the bottom of the ascending cup meets the falling surface *a*. When these reach a common level, as shown by fig. 3, the pressure within this grip has reached the maximum for any phase of its action.

With further progress upward of the inner lift, the entrapped air begins to escape under the cup and into the interior of the holder. This results in a gradual reduction of the pressure within the grip. The surface *a* now rises with the bottom of the cup; its rising signifying the continuing escape of air. Surface *b* is now accelerated in its rise by the reduction of pressure ascending

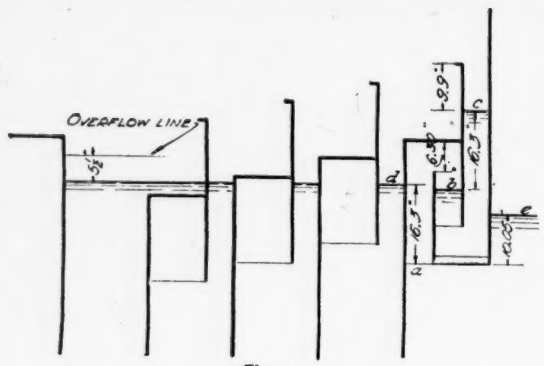


Fig. 3.

faster than the cup, while *c* is retarded—its upward motion being now one-half that of the cup. When the cup and grip have come into passive contact, this behaviour is terminated, and the conditions are as shown by fig. 4. As will be observed, the surface *b*

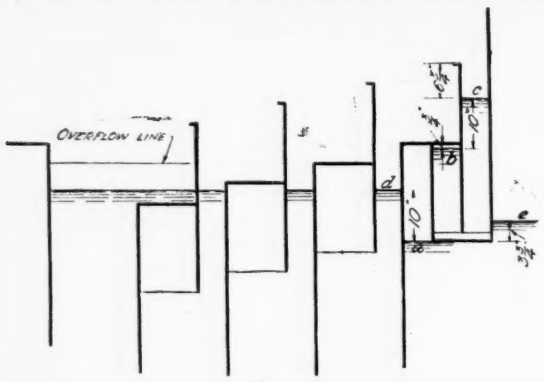
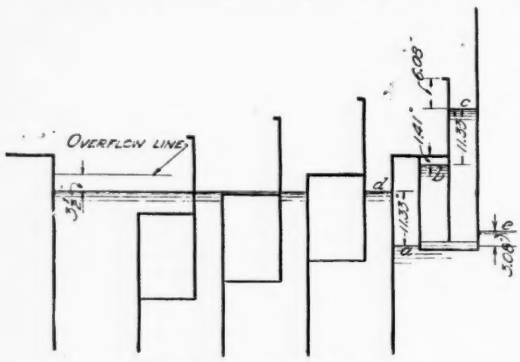


Fig. 4.

reached a point but $\frac{3}{4}$ inch below the lip of the cup. Had the pertaining grip stood more than $1\frac{1}{2}$ inches higher in relation to the tank water, the cup would have overflowed internally.

Fig. 5 illustrates the conditions when the weight of the second

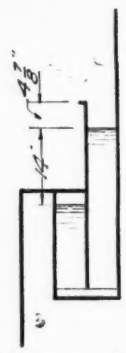


Holder Pressure, $8\frac{1}{4}$ inches.

Fig. 5.

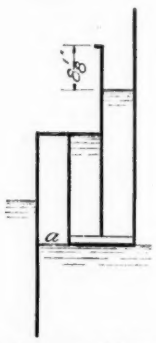
lift has been transferred from the landing blocks to the cup, which is assumed to have occurred without the inner lift rising perceptibly from the position shown in fig. 4. Disregarding for the present the depression of the tank-water line caused by the withdrawal of the cup water, the surface *d* has risen 2 inches, which amount corresponds to the increase of holder pressure due to the second lift. During the brief period in which the outer tank water-level *d* is rising, the surfaces *a*, *b*, and *c* are again reversed in their motion—*a* rising above the bottom of the cup, and thus checking for the moment the escape of air. Surface *b* falls while *c* rises—the amount of change of *a*, *b*, and *c* being the same and one-third of the amount *d* rises, or $\frac{2}{3}$ inch. The pressure of the entrapped air which had fallen to 10 inches (fig. 4) has now risen to 11·33 inches. As the interlocked cup and grip henceforth travel up together, the bottom of the cup overtakes the surface *a* when the escape of air is therewith resumed. As the pressure within the grip is again falling, surface *b* once more rises faster than the cup ascends, and surface *c* falls relatively—both at such a rate that, as in the previous phases, the difference of level between *a* and *d* and between *b* and *c* will be equal to the difference between *a* and *e*, *plus* the holder pressure. If this behaviour be traced to its conclusion, it will be found that, when the bottom of the cup has reached a point $\frac{1}{4}$ inch below the surface *e*, the water at *b* will have reached the lip of the cup. At this instant the surface *c* will be $8\frac{1}{2}$ inches above *b*. Hence, as the bottom of the cup clears the inner tank-water level *e*, and the pressure in the grip equalizes with the pressure of the holder, a volume of water $\frac{1}{4}$ inch deep and 6 inches wide will overflow internally from the cup to the tank.

Fig. 6 shows the same cup when the holder has been fully inflated with air. It will be noted that the water has risen in the outer leg of the cup to a level $4\frac{7}{8}$ inches below the lip of the dam. This is the nearest approach to overflowing for this particular cup under any normal conditions.



Holder Pressure, 14 inches.

Fig. 6.

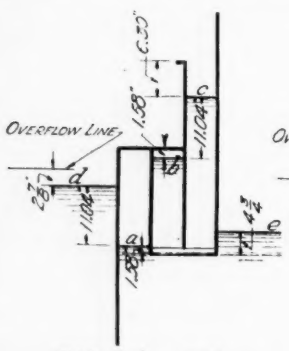


Holder Pressure, with Gas, $7\frac{7}{8}$ inches.

Fig. 7.

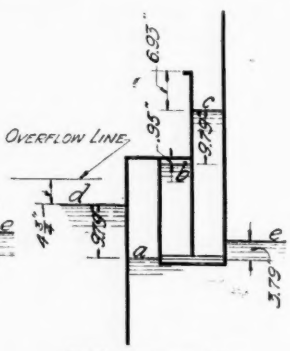
Fig. 7 represents this same cup as it is about to re-enter the tank water; the holder being now assumed to contain gas. By comparing figs. 2 and 7, it will be seen that, while the quantity of water in the cup is but little less than that acquired by the cup in the first phase of cupping, the volume of gas now entrapped in the grip is substantially one-half that of the air previously contained therein. As the holder continues its descent, the tank water acts upon the entrapped gas, causing the surface *a* to fall at but one-third the rate at which the cup is moving. Surface *b* now falls faster than the cup, while *c* is retarded, falling at a rate two-thirds of that of the cup. Fig. 8 illustrates the conditions that obtain when the second section has just touched the landing blocks, but before the weight has been transferred thereto. Fig. 9 shows the conditions immediately subsequent to those of fig. 8; the section being now at rest upon the blocks. Comparing the positions of surfaces *a*, *b*, *c*, *d*, and *e*, it will be observed that when the section landed the exterior tank-water level *d* fell $1\frac{7}{8}$ inches (an amount corresponding to the reduction of holder pressure), *a* and *c* both fell and *b* rose each one-third of $1\frac{7}{8}$ inches, or $\frac{5}{8}$ inch, while *e* remained unchanged. As required for equilibrium, the difference of level between *a* and *d* and between *b* and *c* are both equal to the difference between *a* and *e*, *plus* the holder pressure.

With further descent of the inner section, the cup separates from the now stationary grip, thereby reducing the pressure on



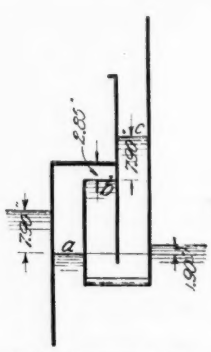
Holder Pressure, $7\frac{7}{8}$ ins.

Fig. 8.



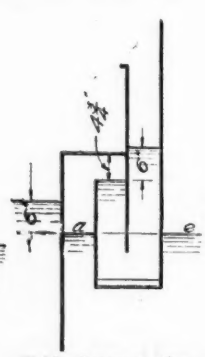
Holder Pressure, 6 ins.

Fig. 9.



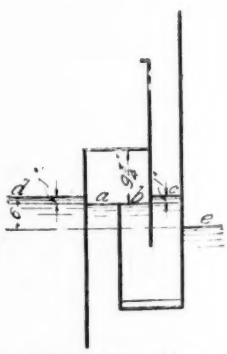
Holder Pressure, 6 ins.

Fig. 10.



Holder Pressure, 6 ins.

Fig. 11.



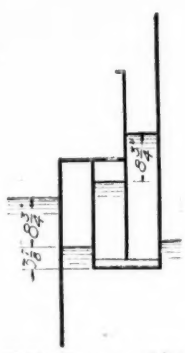
Holder Pressure, 6 ins.

Fig. 12.

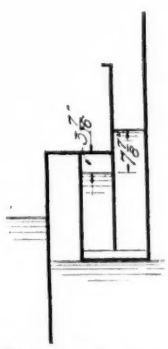
the entrapped gas. As the pressure within the grip is measured during all phases of entrapment by the difference of level between *a* and *d*, the surface *a* must rise. The volume of gas contained in the grip being now constant, the surface *b* falls at the same rate and the same amount that *a* rises. This rate of motion is but two-thirds of that at which the cup is descending. Hence, as the volume of water in the cup is now constant, the fall of the surface *c* as compared to the motion of the cup is accelerated to the same extent that *b* is retarded—that is, *c* falls twice as fast as *b*, and double the amount. It will be observed, from the relation of surface *b* to the lip of the cup in fig. 9, that, as the holder is descending faster than *b* falls, the water will soon reach the lip of the cup as shown in fig. 10. Whereupon, with further movement, the cup will overflow internally. This modifies the behaviour of gas and water to the extent that *a* now rises at the same rate and the same amount that the cup descends, while the downward motion of the surface *c* is twice that of the holder. Fig. 11 shows the conditions that obtain when *a* and *e* reach a common level, and the gas within the grip, though still entrapped, is under a pressure equal to that of the holder.

Fig. 12 shows the uncupping complete. The surfaces *a* and *b* are now rejoined, and *c* and *d* are at a common level, and will not be disturbed by the further downward movement of the inner lift, except to the small amount that both rise as a result of the tank water being displaced by the submerged metal. By comparing figs. 2 and 12, it will be noted that the cup has lost a volume of water 6 inches wide and 7½ inches deep; that the gas entrapped in the grip is but 9¾ inches deep, as against 18 inches of air originally contained therein; and that there is but 1 inch of pressure on the gas in the grip. Fig. 12 also shows the conditions which obtain when, during the next inflation of this holder, the lip of the cup reaches the lower surface of the entrapped gas. The succeeding phases of this cupping are uneventful, the phenomena resembling those of the first inflation, though now none of the entrapped gas escapes, and the pressure in the grip is at all times much less—reaching its maximum when the weight of the second lift is taken from the landing blocks as shown by fig. 13.

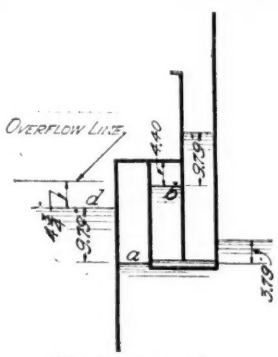
After this inflation, when the holder again descends, the quantity of gas entrapped in the grip is somewhat more than upon the previous occasion; the conditions being shown by fig. 14, and are to



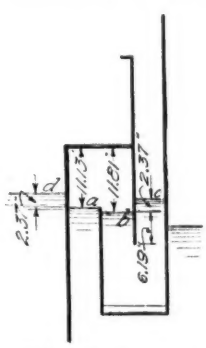
Holder Pressure, 7⅝ ins.
Fig. 13.



Holder Pressure, 7⅝ ins.
Fig. 14.



Holder Pressure, 6 ins.
Fig. 15.



Holder Pressure, 6 ins.
Fig. 16.

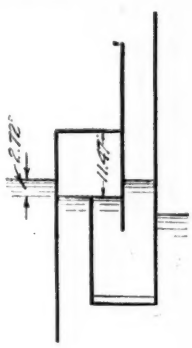


Fig. 17.

be compared with those in fig. 7. With the continued descent of the holder, the surfaces *a*, *b*, *c*, *d*, and *e* repeat the behaviour of the previous uncupping until the phase corresponding to fig. 9 is reached. The conditions pertaining to the instant in which the weight of the second lift came on the landing blocks are shown by fig. 15. Comparing figs. 9 and 15, which represent corresponding phases of the descending holder, it will be observed that, while the volume of water and gas in the cup and grip are incidentally different, the pressure of entrapment is the same. Thus it may be deduced that the pressure of entrapment developed in the cup and grip of a descending gasholder is a direct function of the holder pressure and the amount the lifts have moved downward since entrapment began, and is independent of the volumes of water and gas the cup and grip may respectively contain.

The grip being again stationary, the cup now separates from it, with a brief recurrence of the phenomena previously described as following the conditions represented by fig. 9. As there is now more gas in the grip and less water in the cup than at the time of the previous uncupping, there will result a change in the behaviour from that described in connection with figs. 10, 11, and 12. As before, the surface *a* is rising and *b* falling at a rate two-thirds of that at which the cup is moving. However, as the surface *a* and the lip of the cup are moving in opposite directions, the rate of approach being the sum of their respective rates of motion, or 2½ times the rate at which the lip is overtaking *b*, the lip will now meet the surface *a* before it can overtake *b*, as shown by fig. 16. Hence, with the further descent of the holder, water from the tank will flow over the lip into the cup until *a* and *b* are rejoined, and *c* is restored to the level of *d*, below which it had fallen.

Fig. 17 illustrates both the final phase of this cupping and the beginning of the next one. Comparing the conditions with those shown by fig. 12, it will be noted that the grip now contains more gas and the cup more water than at the time of the preceding inflation. In this connection, it is convenient to direct attention to an interesting but unimportant phenomenon. By comparing fig. 14 as showing the last descent and fig. 17 the present inflation of the holder, it will be observed that, as the cup now contains more water, there will be less gas entrapped when the holder next descends. Comparing now figs. 12 and 17, it will be apparent that the smaller volume of entrapped gas will result in less water in the cup when the gasholder next rises, which in turn will permit more gas to be entrapped upon the next descent. It could be shown that this cycle of more water less gas, less water more gas, continues *ad infinitum*. But the increment of variation is being constantly diminished, and after four or five inflations of the holder becomes less than could be discovered by observation. After the gas and water have assumed their final volumetric relation, the conditions during uncupping vary but little from those shown by figs. 14 to 17 inclusive.

As the action of the intermediate cups does not involve any notable phenomena, they will remain unconsidered, and the behaviour of the outer cup will now be analyzed.

Fig. 18 illustrates the conditions that exist when the fourth section rises out of the tank water for the first time while the holder is being inflated with air. During this phase, the distance from the surface of the outer tank water *d* to the overflow line is 0·57 inch less than the increment of pressure for the fifth section; and the inner surface *e* will still stand above its final level—both *d* and *e* being affected by the displacement of the cup water and the metal still submerged. For simplicity, however, this increment of displacement is not considered in developing the action of this particular cup, as its influence is unimportant. Attention is directed to the pressure of 24½ inches on the entrapped gas, compared to 8½ inches for the corresponding phase of the inner sections, as shown by fig. 2. It will also be noted that the quantity of water entrapped by this cup is greatly in excess of that with which the first cup began its activity.

With the continuing rise of the fourth lift, there will begin a

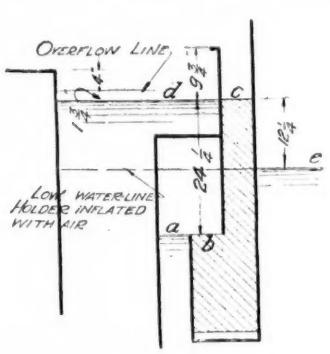
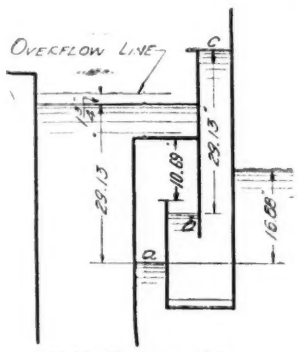
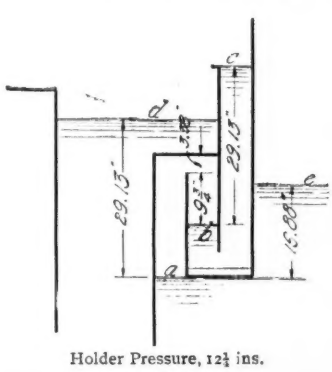


Fig. 18.



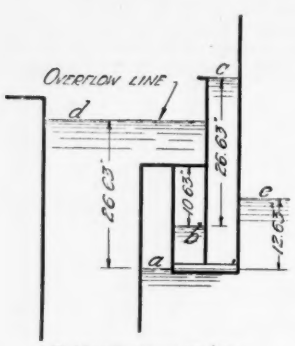
Holder Pressure, 12¼ ins.
Fig. 19.



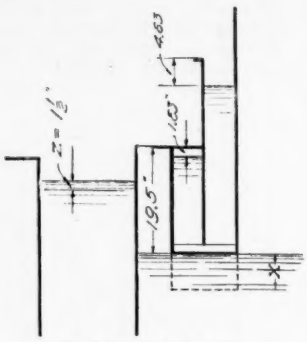
Holder Pressure, 12¾ ins.
Fig. 20.

repetition of the behaviour described in connection with the first cupping of the first and second sections as following the conditions shown by fig. 12. Now, as then, the surface *a* will fall and *b* will rise, each at a rate two-thirds of that at which the cup is moving; while the surface *c* will rise twice as fast as *b*, or one-third faster than the cup. The greater amount of water segregated by this cup quickly results, however, in a variance from the phenomena of the inner sections. In this case, the surface *c* will reach the top of the dip-plate before *a* meets the bottom of the cup, as shown by fig. 19. As the holder continues to rise, water overflows from the surface *c* into the tank. Surfaces *a* and *b* and the pressure in the grip will not remain stationary until the bottom of the ascending cup reaches *a*, when the entrapped air will begin to escape into the interior of the holder. The conditions obtaining at this instant are as shown by fig. 20. Surfaces *a* and *b* will now ascend at the same rate as the holder—*a* remaining level with the bottom of the cup, while *b* remains 9¾ inches below the lip of the cup. It is thus obvious that, during this phase, the volume of air escaping from the grip at *a* is equal to the volume of water overflowing the dip-plate from *c*. This behaviour continues until the ascending holder begins to assume the weight of the outer section. As this occurs, the level of the outer-tank water correspondingly rises, causing the surface *a* to advance above the bottom of the cup, and thus stopping the escape of air; the overflow of water from the cup being meanwhile increased. Fig. 21 shows the conditions that obtain when the weight of the outer section has been entirely transferred from the landing blocks.

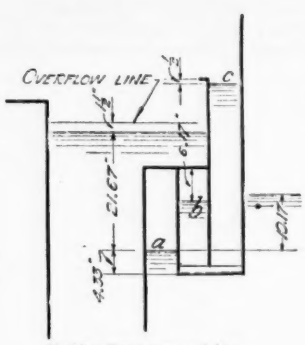
As the now interlocked cup and grip proceed to ascend, there is a repetition of the behaviour previously described as occurring in the interval between figs. 3 and 4. The head of water against



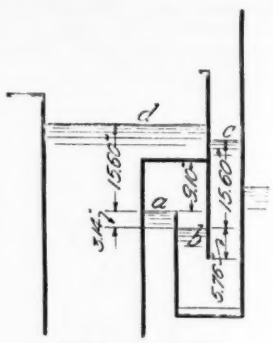
Holder Pressure, 14 ins.
Fig. 21.



Holder Pressure, 13 ins.
Fig. 22.



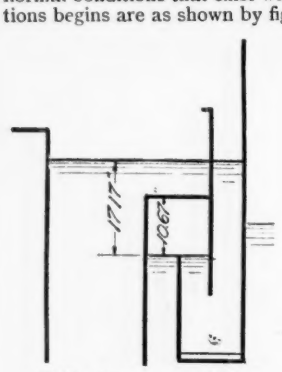
Holder Pressure, 11½ ins.
Fig. 23.



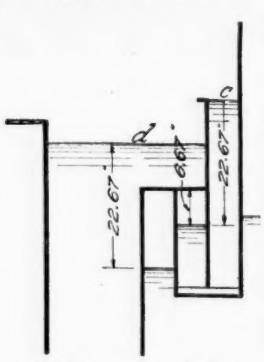
Holder Pressure, 11½ ins.
Fig 24.

the entrapped gas undergoes a progressive reduction. This requires a corresponding reduction in the difference of level between *b* and *c*—that is, *c* must fall and *b* rise, with the result that *a* will again coincide with the bottom of the cup, and the escape of air will be resumed. Herewith *b* ascends still more rapidly until the bottom of the cup reaches the level of the inner-tank water *e*, when the entrapment is terminated, and the pressure in the grip becomes that of the holder. Unlike the innermost cup, during this last phase no water will escape over the lip of the cup when the pressure in the grip falls to that of the holder. Comparing figs. 18 and 21, it will be noted that the cup has lost a column of water 6 inches wide and 18·88 inches high.

After the outer lift has ascended and descended several times, and the holder has been purged, the quantity of water in the cup and the volume of gas entrapped in the grip will have become as shown by fig. 22, which represents the normal operating condition for this cup. Comparing figs. 21 and 22, it will be noted that this cup now contains more water than at the time of the first ascent —the reverse of what occurs in the case of the innermost sections. Passing over the intermediate phases of the descent following fig. 22 to the moment when the weight of the outer lift has been transferred to the landing blocks, the conditions have become as shown by fig. 23. The outer lift being now at rest, the descending cup will part from the grip—the surfaces *a*, *b*, and *c* repeating the phenomena described as occurring in the interval between figs. 15 and 16. The falling cup carries downward the water contained therein; thereby reducing the pressure upon the entrapped gas. Hence surface *a* must rise, for the difference of level between *a* and *d* and between *b* and *c* must at all times be equal. As developed in connection with figs. 15 and 16, the rising surface *a* approaches the lip of the falling cup at a rate 2½ times that at which the lip of the cup is overtaking the fallen surface *b*. When the cup has fallen 9·10 inches from the position shown by fig. 23, water will begin to overflow from *a* to *b*—that is, from the tank to the cup. The beginning of this phase is represented by fig. 24. The normal conditions that exist when the cupping of the outer sections begins are as shown by fig. 25.



Holder Pressure, 11½ inches.
Fig. 25.



Holder Pressure, 13 inches.
Fig 26.

The intermediate phases being now irrelevant, the conditions pertaining to the moment when the weight of the outer section has been entirely transferred from the landing blocks are next considered, and are as represented by fig. 26. The pressure within the grip is at its maximum for operating conditions, and the overflow of the cup has ceased for this inflation. Comparing figs. 25 and 26, it will be observed that with every normal cupping of these sections a column of water 6 inches wide and 7·84 inches high will overflow from the cup surface *c* to the surface of the outer tank water *d*.

There has now been completely developed both the preliminary phases of the cup action and the normal behaviour under ultimate operating conditions of the inner and outermost cups of this hypothetical holder. Though of identical dimensions, the behaviour of the two cups is notably different. The inner cup carries a somewhat smaller quantity of water than the outer one, as may be observed by comparing figs. 14 and 22. However, it meets the crucial test of cup action with even greater efficiency than the outer cup, as may be noted by comparing figs. 16 and 24; and it will perform its proper function as a hydraulic seal, though the water level in either the cup or the tank or in both may have fallen below such limits as are usually permitted.

Referring again to fig. 16, it will be observed that in the final phase of uncupping, in which the tank water overflows from *a* to *b*, the difference of level between the two surfaces is but 0·68 inch, while the distance from *b* to the lower edge of the dip-plate is 6·19 inches. The significance of this relation is that, as the oily scum which accumulates on the surface of the water in the inner tank overflows from *a* to *b*, the fall of 0·68 inch is too slight and too momentary to cause or permit the scum to sink below the dip-plate and rise to the surface *c*. Were the cup to descend deficient in water to an amount of 2 inches, while still efficient as a seal against the escape of gas, its action would result in the oil passing round to the surface *c*. With the continued descent of the holder, this scum would act upon the paint on the outer surface of the inner lift in a manner too familiar to require any further identification.

The corresponding behaviour of the outer cup at this phase is shown by fig. 24. The water and scum overflowing from surface *a* into the cup is more in quantity, has a greater fall, and continues the disturbance of the cup water longer, than occurs in the uncupping of the inner sections. Thus the oil passes down under the dip-plate, and rises to the outer surface of the cup water *c*. When the holder is next inflated, the scum upon the surface *c* overflows the top of the dip-plate on to the surface of the outer tank water, *d*. The termination of this phase is shown by fig. 26. Thus, as the continuing rise and fall of the holder may be of such amounts as to result in the frequent cupping and uncupping of the outer lifts, this cup will act as a very efficient pump, withdrawing the oil from the surface of the interior tank water, and depositing it upon the surface of the outer tank water. The faulty action of this one cup results in the disfigurement of two lifts.

The difference between the behaviour of the inner and outer cups is the consequence of respective differences of two of the conditions that exist at the time of cupping or uncupping. The outer cup acts under a much greater holder pressure than the inner cup, and the outer grip is more deeply submerged in the tank water than the inner grip. While the holder pressure cannot be accommodated to the cup action, the submergence of the grip can; and thereby the transference of oil from the interior of the holder may be avoided. By assuming the volume of entrapped gas to

remain as shown by fig. 25, an equation may be written for the amount the level of the tank water must be lowered to permit the lip of the falling cup overtaking the surface *b* at the same instant that it meets *a*. This equation is,

$$3\,(1{\cdot}83 + \frac{X}{3} - \frac{Z}{3}) = \frac{3}{5}\,(19{\cdot}5 - \frac{X}{3} + \frac{Z}{3})$$

reference being made to fig. 22 for the meaning of the terms. Solving for X, it may be deduced therefrom that if the level of the tank water be lowered some 9 inches, the transference of oil through the cup will be avoided under normal conditions. While the lowering of the tank water would not affect adversely the action of the inner cup, it would permit the entrapped gas to escape from the grip every time the inner lifts were completely uncupped. It could be shown that if the level of the tank water were lowered 7 inches, a material improvement of the action of all the cups would be accomplished thereby. In the construction of new holders, such a relation of the grips to the level of the tank water as that illustrated by fig. 1 should be avoided. If the sections are to vary in height, the outer lifts should be made the higher.

Though cups may be designed to perform their functions perfectly under normal conditions, a deficiency of 2 or 3 inches of water in a descending cup may result in the escape of oil from the interior of the holder. A margin of security against such an occurrence may be provided by perforating the cup plate. The location of the holes must be such that no water can escape from the cup. The conditions pertaining to the outer cup may require the holes to take the form of serrations in the lip of the cup. The holes must provide sufficient area for the two surfaces *a* and *b* to merge without turbulence.

THE PURIFICATION OF COAL GAS.

By Henry Doran, of the Granton Gas-Works.

[A Paper read before the Scottish Junior Gas Association, Eastern District, Nov. 22.]

The efficient purification of gas is a most important point and the fact that many valuable bye-products are derived from the various stages demands that the whole process should receive most careful attention. I think that the best way will be to follow the gas on its passage from the retorts to the meter, and treat each process in its correct sequence.

Foul Main.

The purification actually begins when the gas enters the foul main, as a large proportion of the tar and liquor is removed at this point. The foul main should be as long as the conditions and circumstances of the retort-house will allow, to ensure the gas having the greatest possible contact with the hot tar, and, if possible, should be arranged so as to cause the tar to flow in a contrary direction to the gas—thus serving the part of a preliminary washer. The advantages of this system are very material. First, it allows the gas to become thoroughly saturated with the light hydrocarbon vapours, which tend to increase the candle power, and, what is more important, the calorific value; secondly, the hot tar has a greater solvent action on any naphthalene that may be present, consequently removing it more efficiently. The cooling of the gas on its travel through the foul main should be as gradual as possible, and the main itself should be of ample size. The gas now passes through the

Condensers.

There are numerous types of this apparatus, and the choice of any particular one is, of course, a personal matter; but from the standpoint of gradual cooling, the atmospheric form is certainly the best. At this stage it becomes necessary to break up the minute tar bubbles, and the slow movement of the gas through an air condenser does not always ensure this taking place; possibly the construction of a water-tube condenser possesses this advantage. The gas should be cooled to atmospheric temperature at the outlet of the condenser, and practically the whole of the heavier tar and liquor should be removed. A small proportion of lighter tar passes through the exhauster, where it is beneficial as a lubricant, and is finally removed by the

Tar-Extractor.

This apparatus consists of a number of perforated plates so arranged as to ensure the gas travelling in a zig-zag fashion; thus breaking it up into numerous little streams, and thereby bursting and removing the tar bubbles and tar fog. To ensure this being efficiently carried out, the gas should be at a pressure of 25-10ths to 30-10ths. The gas now passes to the

Ammonia Washer.

There is a large variety of this type of apparatus, of various shapes and sizes, and with varying methods for the extraction of ammonia; but I am of the opinion that the rotary scrubber, preceded by a Livesey washer, forms the best and simplest method of performing this operation. The Livesey washer is best charged with cooled liquor, which can be readily increased in strength to 5° or 6° Twaddel; but beyond this point the strength increases very slowly. The washer also serves as an excellent tar-extractor; and a fair margin of size allowed for the rotary scrubber will afford easy and satisfactory working.

Chemical Tests.

Previous to this stage it is unnecessary to make any chemical tests of the gas; but from this point onwards it is essential to economical working that regular and careful tests be made. A test for ammonia at the outlet of the scrubber should be made at regular intervals, and may be easily carried out in the following manner: Ten cubic centimetres of normal sulphuric acid are placed in a Woulffe bottle, and a little distilled water added to give about a one-inch seal. Then 10 to 15 cubic feet are passed through the bottle, and afterwards through a meter. The contents of the bottle are transferred to a basin, and the bottle carefully rinsed out with distilled water. A few drops of methyl orange indicator is added, and the solution titrated with semi-normal caustic soda, and the amount of ammonia (if any) escaping the scrubber accurately determined. It will almost invariably be found that this test will show a faint trace of ammonia, as it is extremely difficult to absolutely free the gas by using water. But the amount should never exceed 0·5 grain per 100 cubic feet. The solutions necessary for this test are easily prepared, and the test should be employed in every works; for although the use of litmus paper affords a general idea of the condition of the scrubber, it is advisable to check it by actual estimation. It will be opportune at this point to refer briefly to the

Extraction of Cyanogen.

The general trend of opinion at present is rather against this particular branch of purification, on account of the many difficulties it presents, and the somewhat doubtful nature of the profits to be derived; and, further, it is only on very large works that it can be carried out. The general method is to absorb the cyanogen by means of ferrous carbonate in the presence of a solution of sodium carbonate in excess. A rotary scrubber is used with a mixing chamber on top. The percentage of cyanogen in the gas is first estimated, and the necessary quantities of iron and sodium carbonate for its absorption from a given volume of gas calculated and added. When spent, the charge is run off, and evaporated; leaving what is known as crude cyanide cake. It may be sold in this form, or what is more profitable, it may be worked up to a pure crystal salt. The gas now contains carbon dioxide and sulphuretted hydrogen, with a trace of carbon disulphide, and passes to the purifiers for final treatment.

Purifiers.

The purifiers themselves are of two main styles of construction—water-lute and luteless or dry-lute. Both styles have their own particular advantages; but, on the whole, the old water-lute type is to be preferred. One great merit is that the water-seal acts as a most efficient safety valve for practically the entire works—a fact which, I think, is sometimes overlooked. Another point which may be worth mentioning is that, wherever possible, there should be a gradual rise on the main carrying the gas to the purifiers. This will prevent any tar or condensation running forward to the purifier boxes.

Purifying Agents.

Turning to the actual process of purification, the two agents which are almost exclusively used for the removal of carbon dioxide and sulphuretted hydrogen are lime and hydrated ferric oxide; the latter in the form of natural bog ore or artificial iron oxide.

Lime.

Lime as a purifying material is more complete in its action than ferric oxide, as it removes not only sulphuretted hydrogen, but also carbon dioxide and a certain percentage of carbon disulphide. But, as the spent lime has absolutely no commercial value, and cases are even known where money has been paid for its removal from the works, purification by this means becomes an expensive item. As it is still used in many works, I will briefly consider its action and preparation. It is best prepared for use in the following manner: A heap of caustic lime for slaking is piled about 3 feet deep, and to any suitable width. One end is then slaked and banked-up, and the hose, which should have a long iron nozzle, is worked from the top—the nozzle being worked down through the heap of lime. The banked end will retain the water and send it forward through the mass. By this means greater heat is produced, less water is used, and the lime is thoroughly slaked—a result which it is impossible to attain if the lime is spread out in thin layers. The material should be prepared about two days before use, and should be quite cold when placed in the purifier. When in proper condition, a small quantity of the material when pressed in the hand should just retain the shape.

If three or four layers of lime are adopted, the depth of each should be from 3 to 5 inches; but the best result is attained if two layers of 10 inches each are used. The action of water on the caustic lime is as follows:

$$CaO + H_2O = Ca(OH)_2.$$

The result, slaked lime or calcium hydrate, is a compound, and not merely a mixture of lime and water. The action of the slaked lime with sulphuretted hydrogen and carbon dioxide is somewhat complicated; but a general idea of what takes place is expressed by the following:

$$(1)\ Ca(OH)_2 + CO_2 = CaCO_3 + H_2O$$
$$(2)\ Ca(OH)_2 + H_2S = CaS + 2H_2O.$$

These reactions occur simultaneously.

(3) $CaS + H_2S = CaH_2S_2$. A further stage.

These reactions occur in presence of both sulphuretted hydrogen and carbon dioxide; but, on prolonging the contact, the carbon dioxide reacts with the sulphide of lime, breaking it up and forming calcium carbonate or chalk, and liberating sulphuretted hydrogen as shown by the following:—

(4) $CaH_2S_2 + CO_2 + H_2O = CaCO_3 + 2H_2S$.
(5) $CaS + CO_2 + H_2O = CaCO_3 + H_2S$.

So that it will be seen from these reactions that from a prolonged exposure of a lime purifier to the foul gas it is possible to get more sulphuretted hydrogen at the outlet than at the inlet of the box. The absorption of carbon disulphide is sometimes represented by the reaction of $CaS + CS_2 = CaCS_3$, thus forming a simple thiocarbonate analogous to $CaCO_3$ (calcium carbonate). But there is no evidence to show that this compound exists. The absorption of the carbon disulphide is probably due to the formation of what might be termed a hydrated sulphide of lime—thus:

$CaH_2S_2 + H_2O = Ca(OH)(SH) + H_2S$. This, in turn, reacts with the carbon disulphide, as follows:—

$2Ca(OH)(SH) + CS_2 = Ca(OH)_2CaCS_3 + H_2S$.
$3Ca(OH)(SH) + CS_2 + H_2O = 2Ca(OH)_2CaCS_3 + 2H_2S$.

liberating sulphuretted hydrogen and forming a basic thiocarbonate. Heated slaked lime will also absorb carbon disulphide.

$$CS_2 + 2Ca(OH)_2 = 2CaO + CO_2 + 2H_2S.$$

The lime for purification must not contain too much foreign matter, must be of an open and porous nature, and should contain not less than 80 per cent. of free caustic lime.

Bog Ore.

This is the cheapest and most suitable purifying agent at present in use. It is less costly than lime by reason of its power of revivifying. This enables it to be used several times over, and when finally spent its commercial value depends on the amount of sulphur present. There are various ways in which bog ore may be distributed throughout the purifier boxes, by employing one of the several styles of grids. These grids have their disadvantages: (1) They greatly decrease the available purifying area; (2) increased labour; and (3), if revivification *in situ* is practised, the heat generated by the chemical reaction of the oxygen with the ferrous sulphide will be so great as to often char the grids, and may quite easily set them on fire—thus necessitating expensive renewal, and, further, in the case of the oxide working actively, charring may again occur, rendering the grids useless and greatly increasing the dangers of the purifier-house. In my opinion, the best and safest method of using oxide is entirely to dispense with grids throughout the mass, and fill the box in the following manner: 6 inches to 1 foot from the bottom of the box put a layer of lime trays, and upon these place two tiers of flat grids, then fill in the oxide solid to within a few inches from the top of the box. The lime trays will be found to act as a very simple, but satisfactory, screen for any condensation which may be present; thus keeping the lower surface of the oxide free and open to the flow of gas, and thereby reducing the chances of any back-pressure.

In my opinion, oxide should not be revivified in the box either by admitted air or oxygen, for the following reasons: (1) The oxide is in a compact state, therefore the air cannot possibly penetrate to all parts; (2) if air be admitted at any part of the plant, the doubtful saving of labour in connection with the purifier work will be completely counterbalanced by the introduction of the useless nitrogen, as it should be remembered that for every volume of oxygen required, four volumes of nitrogen must be introduced along with it; (3) if oxygen alone is used, I venture to think that the cost of its production would place it out of court. The oxide, therefore, for revivification should be completely emptied out and broken up, and then thoroughly aired and turned over several times.

Difficulties may sometimes arise when bog ore is put in use for the first time, owing to the slowness with which it comes into work. This is no doubt due to the excessive amount of water present. The material should not contain more than 25 per cent. of free moisture at the beginning of any working period. Other means of overcoming this difficulty may be adopted, such as mixing the material with a small quantity of spent oxide. This, of course, lowers the purifying efficiency of the material. Another, and perhaps the best, method of using iron oxide is to employ a mixture of three parts bog ore to one part of artificial iron oxide. This mixture will give very good results for several reasons. The artificial iron oxide imparts a rapid and positive action to the mass, and increases the percentage of ferric oxide; while, on the other hand, the bog ore keeps the material open and porous.

The reaction of ferric oxide with sulphuretted hydrogen is a simple one. What takes place in the purifier is expressed by the following:—

$$Fe_2O_3\,3H_2O + 3H_2S = 2FeS + 6H_2O + S.$$

The reaction which occurs during the process of the revivifying is also quite a simple one:—

$$2FeS + 3O + 3H_2O = Fe_2O_3\,3H_2O + 2S.$$

In the choice of bog ore, there are three points which should be kept in view: (1) The percentage of hydrated ferric oxide or actual purifying material present; (2) the amount of organic or rooty matter; and (3) silicious matter.

Hydrated Ferric Oxide.—This exists in at least three modifications—namely, combined with one, two, or three parts of water—and any or all of these may be present in the bog ore; so that it is necessary to fix one formula as a standard, and calculate all the results to this. $Fe_2O_3\,3H_2O$ is the most convenient; and the bog ore should contain from 72 to 75 per cent. of iron oxide in this condition.

Organic or Rooty Matter.—This is a most important factor in the successful working of the material, and should be given careful attention to. It should be in such proportion to the ferric oxide as to ensure the material being kept open and porous, in order to afford the gas an easy passage, and should not be less than 20 per cent.

Silicious Matter.—This should not exceed 2 per cent.

Therefore, going on the above lines, an analysis of a good bog ore should show, approximately: Hydrated ferric oxide, 75 per cent.; organic or rooty matter, 20 per cent.; silicious matter, 2 per cent.; the last 3 per cent. being aluminium and other metallic oxides. The amount of free moisture usually found in bog ore is about 50 per cent. It is a matter for arrangement between buyer and seller; but the amount should never exceed 50 per cent.

Sampling and Testing.

The correct sampling of the material to be tested is a most important matter, and very careful attention should be given to it; for unless the sample can be said to fairly represent the entire mass, it is useless carrying out any tests.

Lime.—In this case, the testing is quite simple. A sample of the caustic lime having been obtained, a suitable quantity is taken (0·5 to 1 gramme) and dissolved in hydrochloric acid and filtered, and the filter paper thoroughly washed with distilled water. The filtrate and washings are brought to boiling point, and ammonium oxalate added in sufficient quantity to completely precipitate the lime. The whole is allowed to stand for two hours, then filtered off, and the residue washed. After washing, the residue is placed in a weighed platinum crucible and heated by the blow-pipe until constant in weight, and the increase in weight thus found is lime, CaO. The testing of a spent lime is practically unnecessary, besides being most complicated.

Hydrated Ferric Oxide.—In testing this material, the three principal substances which require to be estimated are ferric oxide, free moisture, and silicious matter; and the analysis can be carried out in the following way: A large sample having been obtained, three quantities of 20 grammes each are taken and dried at 212° Fahr. to constant weight, and the average of the three results is recorded as free moisture. The three dried samples are now mixed together, ground to a very fine powder, and kept dry in the air-oven. From this, 2 grammes are weighed out, placed in a weighed platinum crucible, and heated by the blow-pipe; the lid of the crucible being kept on for the first few minutes. The heating is continued until no further loss of weight takes place, and the total loss of weight is recorded as water of combination and organic matter.

For the estimation of the ferric oxide and silicious matter along with alumina, 0·5 gramme of the dried sample is treated with hydrochloric acid, a few drops of nitric acid being added, and the mixture kept near the boiling point till the iron is completely in solution. The solution is diluted with distilled water and filtered, the insoluble matter carefully washed, placed in the crucible, heated, and weighed in the way previously described; the result being recorded as silicious matter. The filtrate and washings containing iron and aluminium are now taken, ammonia is added until no further precipitation occurs, and the whole then filtered. The residue (iron and aluminium) is washed with warm dilute hydrochloric acid and reprecipitated by a strong solution of caustic potash. By this means, the iron is precipitated alone; the aluminium remaining in the solution. The iron is filtered off, redissolved in hydrochloric acid, and reprecipitated by ammonia, filtered, washed, heated, and weighed in the usual manner—this giving the percentage of ferric oxide (Fe_2O_3), which is calculated to the standard formula. The caustic potash solution containing aluminium is acidified, and the aluminium again precipitated and treated in the same way as the iron. This gives the weight of aluminium oxide (Al_2O_3).

For testing samples of bog ore for sulphur at any time during its working period, I think the following as quick and simple a method as can be used. Ten grammes of the sample are weighed into a small basin and dried at 212° Fahr. Loss in weight equals free moisture. The dried oxide is ground fine and placed in a tap-funnel half full of cotton wool, and washed with carbon disulphide until the latter runs through clear. The liquid is caught in a weighed flask, and the carbon disulphide subsequently distilled off and the flask finally dried in the air oven and again weighed. The increase in weight represents the percentage of sulphur on the wet basis. There is generally a trace of tarry matter dissolved out by the carbon disulphide; but this may be neglected unless its estimation is desired separately, as the test is a comparative one.

Having described the various processes and the more simple and necessary tests, I think it will be interesting if we turn our attention for a few minutes to

Liquid Purification.

This means complete purification of the coal gas by means of liquids in closed vessels. Principles employed in this method may

be said to be the ideal purification; and though it has received intermittent attention for many years past, it is only quite recently the united attention of the gas industry is being directed toward it. At present there is practically no definite information as to the working process in detail or comparative costs with existing methods. The main underlying principle of liquid purification is that ammonium hydrate will absorb sulphuretted hydrogen and carbon dioxide, and, by increasing the number of scrubbers and using ammonium hydrate in excess, the sulphuretted hydrogen and carbon dioxide may be almost completely removed, and ferrous hydrate mud used to completely free the gas of the last traces of sulphuretted hydrogen, and the final scrubber containing dilute sulphuric acid to entirely remove ammonia, forming sulphate of ammonia. The acid must be so dilute as to have no action on the hydrocarbons in the gas or the scrubber plates.

A pure ammonium hydrate is not absolutely necessary, as a semi-purified liquor, such as could be drawn off from the ammonia still in a sulphate plant—say, one-third down the still column—might contain sufficient free ammonia to perform this work. The acid from the final washer containing sulphate of ammonia in solution could either be evaporated separately or run into the ammonia saturators if a sulphate plant was in use.

We are all indebted to Dr. W. B. Davidson, of Birmingham, for the publicity he has given to his valuable researches on this problem; and I think it will be interesting to all of us to quote the operations which are successfully working under his direction at the Nechells Gas-Works, Birmingham. There are five separate parts of the plant.

(1.) *Tar Extractor.*—Completely removing tar.

(2.) *Cyanide Washer.*—Using sludge effluent from No. 5, extracting the cyanogen, some ammonia, H_2S, and CO_2.

(3.) *First Ammonia Washer.*—Using purified ammonia (either liquor or ammonia gas and water separately), extracting the bulk of H_2S and CO_2.

(4.) *Second Ammonia Washer.*—Using water and extracting ammonia and a further portion of H_2S and CO_2. H_2S must be reduced to less than 0·02 per cent. by volume.

(5.) *Final Washer.*—Using in the lower portion ferrous hydrate sludge to extract the last traces of H_2S, together with ammonia, and, in the upper portion, water or ammonium sulphate and sulphuric acid to remove the last traces of ammonia.

This, in brief, is the scheme which is working successfully in Birmingham. But as the scheme which is generally adopted would entail an extensive installation of purifiers being put out of action, I think that some lengthy period lies before its final adoption.

DISCUSSION.

Mr. P. Low (Montrose) remarked that what they wanted in purification was to get rid of the non-illuminants in the gas after it left the retorts. But in doing this they had to be careful not to eliminate any of the illuminants. With regard to the gas in purifiers, they put in a certain percentage of sawdust, which made the oxide not only more porous, but absorbed more of the water. He thought this was probably done in most gas-works.

The PRESIDENT said he was sorry there had not been a brisk discussion, but he quite understood the difficulty of following a paper like the one before them. They wanted to have it at home and to think over it quietly. He should like to ask Mr. Doran a question as to the size and arrangement of the purifier boxes. What did he consider to be the best material to use—natural ore or artificial substitutes, such as the Lux material, which was greatly in use nowadays? He should also like to ask the author what had become of the material known as Weldon Mud, about which they used to hear so much as a purifying agent some years ago. He had not heard anything about it lately. He did not profess to be an expert, and as Mr. Doran had devoted all his time and attention to the subject of purification for a good many years, he, if any man, would be able to clear up points in connection with it. They were much indebted to him for coming there to read the paper; and he (the President) asked the members to accord him a hearty vote of thanks.

Mr. DORAN, having acknowledged the vote, said, with regard to the sudden cooling of gas, he had stated in his paper, and he reiterated it, that this should be as slow and as carefully done as possible. He thought a sudden drop in temperature would be more detrimental to gas than gradual cooling. The bulk of the illuminants were the heavy hydrocarbons or the benzene series, and the latter were obtained from the tar. The longer gas could be kept in contact with hot tar, the more it would take up the heavy hydrocarbons. Mr. Geddes had referred to one or two points. The arrangement of the purifier-boxes was a personal matter altogether. He expected it would depend on the location of the works, and how the ground was situated. He should not like to put forward his own view as to arrangement, as authorities differed in this respect. As to the use of bog ore, he quite thought that if artificial oxide could be employed at all by itself it ought to be done. An artificial oxide was usually very fine. It was a prepared substance. Bog ore was fine only when mixed and broken up with organic matter. If they mixed the prepared oxide with sawdust, they were only decreasing the purifying efficiency. If they put (say) from 10 to 15 per cent. of sawdust into the artificial oxide, they were taking this away from its efficiency. As to Weldon Mud, which was derived from the manufacture of bleaching powder, if it could be got in sufficient quantity, it would certainly beat natural bog ore or artificial oxide. It was not, however, made to a very great extent.

NOTES ON SULPHATE OF AMMONIA MANUFACTURE.

By A. R. WILSON, of Perth.

[A Paper read before the Scottish Junior Gas Association, Eastern District.]

It is now customary for gas undertakings to work up their own ammoniacal liquor in order to save the expense of conveying large volumes to a central manufacturing station; and it is significant that an increasing number of the smaller concerns are finding the installation of a sulphate of ammonia plant a paying investment. In view of this, a description of the Perth plant, together with some general notes on points which have occurred while working it, may prove of interest to the members.

The designed production of the plant is 2 tons per diem. The still, which is of the Gillespie type, consists of 10 trays or shelves situated on top of each other. Each tray measures 5 ft. by 3 ft. 9 in., and has 45 "bubbling" holes distributed over it. The depth of the seal on each tray is 2½ inches. The liquor enters at one corner, passes over all the "bubbling" holes, and, on reaching the opposite corner, drops down to the next tray. The liquor thus undergoes a vigorous agitation and prolonged boiling. After traversing six trays, the liquor is diverted into the liming chamber, returning to the still again, where the distillation is completed. The principal features of the still are the large number of "bubbling" holes (450 in all) and the thorough agitation and boiling which the liquor receives.

A Wilton pump is used for delivering the milk of lime to the liming chamber. A description of the pump may prove interesting, as it works on a principle different to most pumps. It consists of a cylinder, inside of which works a loosely fitting float. The lime water flows by gravitation from the mixer to the bottom of the cylinder, raising the float, which, in turn, raises a spindle connected through a stuffing box to a steam-valve on the top. When the float has risen to its full height, the steam-valve is automatically opened, allowing the full steam pressure to act on the surface of the lime water and forcing it into the liming chamber. The float then gravitates to the bottom of the cylinder, closing the steam-valve, and the cycle is then repeated. The pump works very smoothly, and requires the minimum of attention.

Prior to entering the still, the liquor passes through the superheater, where the temperature is raised by means of the waste gases to 180° Fahr., leaving only a difference of 32° to be made up in the still. In its passage through the superheater, the liquor is divided up into three streams, and this greatly facilitates the transfer of heat from the waste gases.

The saturator, which is of the usual pattern, is fished by hand; the ammonia being brought into contact with the acid by means of two cracker pipes.

A centrifugal drying machine is installed, the basket of which is 24 inches in diameter by 15 inches deep, and is lined with three copper gauzes, each of different mesh. These linings require to be frequently renewed.

The acid storage tanks, two in number, are situated inside the house; the acid being delivered into them from a railway tank-waggon by means of compressed air. For this a Westinghouse compressor is used.

The waste gases leaving the superheater are led through a vertical condenser consisting of six double loops of 5-inch pipe, 9 ft. 6 in. high. The cooled gases then pass to the oxide purifiers, of which there are two; each being controlled by a water trap-valve. The purifiers consist of heaps of oxide placed in the open, the waste-gas pipes being led into the centre of the mass and protected with ordinary sieves placed against each other. The store, the walls and floor of which are lead-lined, is capable of holding 130 tons of sulphate—about half our production.

In deciding upon the size of the still, it is wise to err on the safe side, as nothing contributes more to wasteful work than having to drive it beyond its capacity.

Variations in steam temperature are inevitable, especially where the supply is taken from the works boiler; and such variations are reflected in the increased amount of ammonia lost in the spent liquor, owing to insufficient boiling. We find that a thermometer fitted on the liquor pipe at the outlet of the superheater is of great service in regulating the working of the plant, as by its means any decrease in steam temperature is made apparent, and correction made accordingly. The thermometer is fitted in such a position that the attendant can keep an eye on it while fishing the saturator.

As the "fixed" ammonia in our liquor amounts on an average to 10 per cent. of the total ammonia, particular care has to be taken to ensure that the still is supplied with an ample and regular feed of milk of lime. Lately we had considerable trouble with our liming apparatus, owing to the amount of impurities in the lime; but, since starting to use Yorkshire lime, we have had no difficulty in maintaining a constant and uniform supply. The Yorkshire lime costs considerably more per ton; but improved results obtained have justified its introduction. The supply of lime is regulated so as to keep the spent liquor a light claret colour, as this colour indicates that practically the whole of the fixed ammonia has been recovered.

The question often arises: Does it pay to recover the "fixed" ammonia? In our case its recovery represents an increased

yield of 2 cwt. of sulphate of ammonia per twenty-four hours, which, at £13 10s. per ton, is equal to 26s. The expenditure only amounts to 1s. 1d. for lime, *plus* the cost of steam and oil. No expense is necessary for water for making the milk of lime, as the spent liquor can be utilized for this purpose, and, indeed, is preferable, as, on the spent liquor coming into contact with the fresh lime in the mixer, any appreciable uantity of ammonia present will show up and can be remedied.

A possible source of trouble and loss is through the cracker pipes choking and the resulting back-pressure blowing the joints just inside the saturator, thereby allowing ammonia gas to pass away direct to the waste-gas pipe. Regular testing of the waste gases is necessary to discover such defects. It also acts as a check on the management of the bath, as, for instance, the loss of ammonia through fishing the bath too low, or allowing the strength of the bath to reach neutral point.

Constant rubbing of the fishing ladle wears the sides of the saturator to such an extent that in time a hole may develop, and cause a leakage. A preventative against this is to line the bottom and sides with wood. The wood is loosely fitted in, and can be easily renewed when necessary.

While the use of a centrifugal drying machine is an advantage in causing the salt to keep loose and open in the store, with no hard lumps present, it is a question whether it is of material advantage to the seller, because of the resulting light weight of the salt. Of course the dried salt shows a higher percentage of ammonia; but, unless the salt is paid for on the basis of unit strength of ammonia, there is no gain to the manufacturer.

DISCUSSION.

In answer to a few questions asked at the close of the reading of the paper,

Mr. WILSON said he had been requested to state how long the linings lasted. During the first year they went through four sets. They were rather expensive, as they came to £2 a set; but they made an improvement in the method of placing the inner copper lining in the basket. Instead of allowing the ends to overlap, they clasped them together. This stiffened the lining, and enabled it to withstand the action of the wooden spade used for lifting out the sulphate. They now went through only two linings in the year. Reference had been made to liquid ammonia. It was no doubt a very desirable thing to have plant for making it, especially in a town like Perth, where there was such a demand in connection with dyeing works. In Paisley, for instance, they had a set for making sulphate and also liquid ammonia, and they worked these as the demands of the market required. As to the lime still, it was distinct from the proper still. About a ton of acid was used to a ton of sulphate made.

Mr. Wilson was cordially thanked for his paper, which, it was explained by the President, had been prepared on comparatively short notice, as they had been disappointed in another direction.

PROTECTION OF STREET MAINS.

The subject of the protection of street mains by the intelligent use of underground space was dealt with by Mr. J. A. GOULD, the Engineer of Distribution of the Consolidated Gas Company of Boston (Mass.), at the last meeting of the American Gas Institute.

The author began by remarking that the laying and maintaining of street mains in the congested districts of large cities is one of the serious problems now confronting the distribution departments of gas companies. If the trouble were confined to the laying of these pipes, it would, he said, be serious enough, but it would be endurable for the brief period when the main is being laid; but the maintenance of the pipes is an ever-present responsibility, and it accumulates with each additional main put down. If the breaks and leaking joints caused by the interference with gas companies' pipes by the pipes, conduits, and structures of other companies could be eliminated, the life of the men responsible for the maintenance of the pipes would be much happier, and the expense much more satisfactory to the directors, than they are now.

The author considered that a long step towards avoiding the present troubles would be made if it were possible to devise some system for assigning proper locations for subsurface structures in all new streets liable to develop into congested districts, or that would be occupied in time by a large variety of pipes and conduits. But even if such a scheme should be in force, serious trouble would, he thought, probably develop unless these structures were laid in their proper sequence, so that those first put down should not be undermined by subsequent work. If there could be some experienced, air-minded official or board who would have the power to determine just where all pipes and conduits should be placed, so that each structure, whether owned by the city or a corporation having legal rights in the street, would be given proper position, conditions should improve greatly. This official ought to be familiar with the laying and maintaining of all these structures, so as to locate them intelligently in the best interests of all concerned, and should be free from all bias or prejudice for or against every interest involved. Such a position would be no sinecure, and would require tact in order to adjust conflicting interests and do justice to all.

The following is the method now in force in Boston for obtaining a permit for a new main: The Engineer of Distribution compiles a plan showing all existing structures in the street, and indicates the desired location of the new pipe. A blue print is sent with the application to the office of the Commissioner of Public Works, and the location is approved successively by the Engineer of the Sewer Division, the Engineer of the Water Division, the Engineer in charge of grades and catch-basins, and finally by the Division Engineer in charge of the Highways, who endorses the application, and the Permit Clerk issues the necessary permit. This supervision is only to protect the municipal structures, regardless of its effect on the interests of other corporations.

The author went on to say that every corporation or municipal department in a growing city is sure to outgrow the capacity of the original pipes and conduits, and the locating and laying of reinforcing pipes is a serious problem. But, above all things, the problem of maintaining existing pipes in a safe condition is the most serious one for the gas company; and it is not always the last man in the street who has the worst of it. Everyone knows that a cast-iron pipe that is undermined is liable to settle and either leak or break. This is especially dangerous when a manhole is built so as to enclose or support the pipe, while the adjacent lengths are depending on soft backfilling for support. The pipes may be so covered or crowded by new structures that it is practically impossible to caulk the joints; and large bills for damage to electric cables may be incurred by driving bars and picks when making necessary repairs.

From the author's investigations of conditions existing in several of the larger cities of the States, widely distributed from Maine to Oregon, he found the solution of this problem was often a local one; as some of the conditions varied in different cities. But he thought Philadelphia came as near to a standard system of locations for pipes, sewers, and conduits as any of the principal cities. Locations of most of the underground structures were, he said, assigned by the Board of Highway Supervisors, consisting of the Director of Public Works (the President), and the Chiefs of the Electrical, Highway, City Property, Survey, and Water Bureaux. The standard locations generally followed were: Gas, 3½ feet from kerb; telephone, 5 feet from kerb; sewer, 7 or 8 feet from kerb; electric railroad conduit, close to either rail; water, in centre of street.

Mr. Gould remarked that Mr. Forstall states that this plan of standard locations often receives a set-back, other than that due to existing structures installed before the plan was inaugurated, owing to the fact that the three city bureaux which instal underground structures lay their own pipes or conduits without consulting the Board of Highway Supervisors, and take any location they deem best for themselves. Thus it is seen that any carefully thought-out system will prove a failure if the city departments, which are responsible only to themselves, ignore its provisions.

Fazakerley Gas Supply by the Liverpool Corporation.

Under the auspices of the Fazakerley Improvement Association, a largely attended public meeting was held last Wednesday to protest against the high price and the bad quality of the gas supplied to the district by the Liverpool Corporation. A resolution submitted to the meeting set forth that the present charge for gas was 2s. 6d. per 1000 cubic feet, whereas in other parts of the city it was only 2s. 1d., representing an excess of 20 per cent. It also called upon the Liverpool City Council to appoint a Special Committee to inquire into the manufacture of gas at the Corporation's works, and ascertain on how many occasions recently the supply had failed; also to make particular inquiry regarding the quality and pressure of the gas in comparison with those of the Liverpool Gas Company. It was suggested that the resolution should be submitted to the Lord Mayor and members of the City Council. Mr. Wilkins, who moved the resolution, said they had endured the present state of things long enough, and something must be done and at once. It was for the Corporation to reduce the price and improve the quality of the gas, or to allow the Company to supply the district. The pressure was so low as to make it a great inconvenience to the consumers; while from the gas there was also a most objectionable odour, which was injurious to health. As a matter of fact, there was more odour than light. If the Corporation were unable to compete with the private caterer, they should not make any attempt to supply gas; and if they desired to make experiments, they had no right to make them at the expense of a particular section of the city. He was sure that if the protest was not effective it was not their last resource; and they would not be slow to adopt other measures. The resolution was carried unanimously.

The Mayor of Stockport and the Recent Strike.—Reference to the recent strike at the Stockport Gas-Works was made last week by the newly-elected Mayor (Councillor T. W. Potts, J.P.), at a gathering attended by the town's leading representatives. In the course of a long speech, he said the strike was most lamentable. He was sure everyone would agree that such an occurrence was of no benefit in the long run to either the workers or the town. He hoped that during the coming year some means might be devised whereby it would be rendered practically impossible for such a state of things to arise as had occurred during the past municipal year. He thought that while one recognized, and must recognize, that the work of the different departments of the Corporation must devolve upon the Committees appointed to carry it on, and while their duties must primarily be executed by them because they stood between the workers and the ratepayers, and should therefore be fully supported, still, in his opinion, it should not be impossible to devise some scheme whereby, when the workers and the Committees could not be reconciled, such a state as existed during the recent gas strike should not be possible.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Anglo-American Exhibition, 1914.

SIR,—May I trespass upon your space in order to bring up-to-date the subject of a gas exhibit?

I have seen the President of the Institution of Gas Engineers, who informed me that the matter was discussed by an Emergency Committee of the Council, and the conclusion arrived at that it could not in its official capacity father the proposal. One can hardly be surprised at this, having regard to recent events.

On the other hand, we have received offers from two gas companies suburban to London, expressing their desire to contribute to the cost of a gas exhibit, if the South Metropolitan Gas Company will undertake its organization and management.

But it is my firm conviction that the London and Suburban Companies cannot be asked, or expected, to bear the cost, which should be provided by the British gas undertakings. I have every reason to believe that the exhibition of 1914 will be an affair worthy of the two great nations taking part in it, and that it will attract hundreds of thousands of visitors from all parts of the Kingdom—the very people indeed to whom we want to sell our gas.

The exhibition is to celebrate "One Hundred Years of Peace." Why should not the gas industry celebrate "One Hundred Years of Gas Lighting?" This side of our business was certainly not adequately developed recently; to put cooking and heating and brazing and melting on one side, and confine our attention to what is the backbone of our business—gas lighting.

A detached building in a good position just beyond the "Court of Honour," and similar in size and character to that which will be occupied by "Chemical Industries," is still available as a "Hall of Gas Lighting." But it is not likely to remain so long. If sufficient support to the idea is accorded by the Provinces, it would appeal with such weight to the London and Suburban Companies that they would not be likely to receive the proposal unsympathetically.

In this event the South Metropolitan Gas Company would undertake the organization and management, aided by attendants supplied by subscribing companies and to whom the training in gas-selling would be of the greatest value.

But there is no time to be lost. Will those in favour kindly signify without delay to the Secretary of the Company, Mr. F. M'Leod?

CHARLES CARPENTER,
Chairman, South Metropolitan Gas Company.

Old Kent Road, S.E., Nov. 22, 1913.

SIR,—In reference to Mr. Harman's letter in this week's "JOURNAL," I should like to assure him that there is no necessity for the appointment of such an Emergency Committee of this Association as he suggests, as one already exists, and a vigilant watch is kept for all matters that may prove to be of importance to the commercial side of the industry. In this we ask—and frequently receive—the co-operation of our members.

The question of the Anglo-American Exhibition of 1914 was made the subject of inquiry and consideration some time before the opening of the gas exhibition, and was not, as has been suggested, lost sight of on account of the latter.

W. M. MASON, Secretary.
47, *Victoria Street, S.W.*, British Commercial Gas Association.
Nov. 22, 1913.

Mr. Yates and Gas-Fire Testing.

SIR,—According to the report in your columns of the lecture delivered at Manchester University on the 13th inst., Mr. Yates by inadvertence attributed to me a view which I do not hold. He says, "I see Mr. Hartley in the course of his recent lecture confirms what has been our own experience with the method—viz., its margin of error is only 1 per cent."

I am of the opinion that the inherent weaknesses of the R. H. Smith radiometer render it probable that the results obtained by the Leeds method when that instrument is employed contain an error appreciably greater than 1 per cent.—this error in many cases being a constant one. This was indicated in the early part of my lecture; and later I cited results which appear to indicate that the employment of the Rubens thermopile may introduce further errors, although it is not by any means impossible that, under certain circumstances, the various errors of individual readings may be neutralized.

In the appendix to his paper, Mr. Yates described the manner in which he employs the Leeds method at Birmingham. Speaking of the radiometer determinations he says: "Two determinations are made. One of these is taken with the radiometer fully exposed to the fire; the other with its surface shielded from the radiant heat by *a bright metal plate*. The latter experiment determines the number of calories which are imparted to the water by the warm air of the room (convected heat), and which would otherwise remain erroneously included in the radiant heat; *and these are deducted from the number determined by the former*."

In the previous excerpt, I have italicized certain parts which were not italicized in the original. From the description given by Mr. Yates of the working of the method, it appears to me that this may allow of the introduction of at least three possible errors in the radiation determination, and in this connection I would respectfully submit for his consideration the following three criticisms.

(*a*) That one brightly polished copper plate, with an average reflecting power of the order of 94 per cent. for radiation in the infra-red, is not sufficient to prevent all the radiant heat from some of the modern gas-fires reaching the face of the radiometer. At least two such sheets at a suitable distance apart should be employed. When we experimented with reflectors, we decided that with the metals generally available more than one plate was advisable, and during the past few days we have confirmed this. With a single sheet of brightly polished copper shielding the tubes in a particular case, we found that heat was being absorbed by the water at the rate of 19·37 K.C.U. per hour; while with two sheets in front of the instrument the heat absorbed fell to 15·39 K.C.U. per hour.

(*b*) That an error is made in assuming that the heat absorbed under heading (*a*) above should be subtracted from the total heat absorbed when the tubes are exposed to the rays from the fire.

Newton's law of cooling states that: "The velocity of cooling of a body is proportional to the difference between its temperature, and that of its surroundings." This law is sufficiently accurate for the present purpose where we have a negative velocity of cooling—*i.e.*, a heating-up—due to the difference between the mean temperature of the water in its flow through the tubes and the air of the laboratory.

The figures given in the following table represent the temperatures recorded at the radiometer during the test of a fire (1) with the radiometer tubes shielded, and (2) with the tubes exposed to the radiations from the fire.

	(1.) °C.		(2.) °C.
Temperature of water entering the instrument	13·05	..	13·05
,, ,, leaving ,,	14·35	..	23·81
,, test room.	22·4	..	22·4
Mean temperature of water in the radiometer	13·70	..	18·43
Difference between mean temperature of water in the instrument and that of test room .	*8·70*	..	*3·97*

Thus it will be seen that the difference in temperature between the water in the radiometer tubes and the air of the room is materially different in the two cases, so that it is fallacious to subtract the total heat absorbed per hour in case (1) from the total heat absorbed per hour in case (2) in the estimation of the heat radiated by the fire on to the area of one square foot.

(*c*) That a third error is introduced due to the inherent weaknesses of the R. H. Smith radiometer which in part affects the calculation under (*b*) above. Some of the errors due to the instrument may be largely, although not completely, eliminated by the employment of a protective covering of the nature which I indicated at Leeds. To eliminate all errors involves radical changes in the instrument which at the moment I do not propose to discuss. We have constructed and are employing in Warrington a radiometer (area 1 foot square) which we hope to discuss in conjunction with the R. H. Smith radiometer at a later date, when we will indicate the extent of the various errors introduced at the different points.

With regard to the radiometer, it must not be overlooked that in the first instance this instrument was employed in the examination of a fire using about 2500 K.C.U. per hour and radiating about 800 K.C.U. per hour, whereas at the present day we have at times to deal with fires using 7500 K.C.U. per hour and radiating about 4000 K.C.U. per hour, from which it will be realized that an instrument which might be employed satisfactorily in the first instance might not be suitable for the second case.

I notice that a clerical error crept into my lecture report, and I wish to take this opportunity of correcting it. In one or two places I refer to "corrected thermopile readings 5° E to 5° W—these should read 10° E to 10° W.

HAROLD HARTLEY.
Nov. 21, 1913.

The Supply of "Metro" Gas-Burners.

SIR,—I have been interested in the remarks made by Mr. Tilley at the recent meeting of the Society of British Gas Industries; and as he so pointedly alludes (though not by name) to this Company, I should be glad if you would allow me to refer to the other side of the question.

My fundamental belief is that there exists among gas undertakings a community of interest in the fulfilment of their obligations.

During the great coal strike, we were approached by the gas manager of a cathedral town to let him have coal to keep his works going. We did so, and had the satisfaction of knowing that our help enabled him to maintain an unrestricted supply where competition with electricity was of the keenest.

It may be argued by Mr. Tilley that this was a case of necessity, and very different to providing gas-burners. In my judgment the burners are even a greater necessity. The public would, under the circumstances, have been sympathetic with a bad supply of gas; but they are not likely to be so with bad burners in their houses.

Yet in most of the domestic burners in use to-day, the principles which should underlie their construction have been overlooked or ignored.

For some five years, we have given time, and thought, and money to a solution of the problem; and the result has been the "Metro" burner, of which something like 100,000 are in use.

It is as ridiculous to suggest that we must not sow, as that we may not reap where we have sown, or that others should not be allowed to share the harvest.

Do the builders of gas-engines ever supply producer plants in competition with gas undertakings? Or the makers of gas-fires, coal grates? Or the manufacturers of burners, electric fittings? Of course they do; but I never heard of any gas company complaining of it as an injustice. The industry to-day requires the best appliances to be had, and it may be trusted to obtain them whoever the inventors or whatever the labels.

CHARLES CARPENTER,
Chairman, South Metropolitan Gas Company.

Old Kent Road, S.E. Nov. 22, 1913.

Test of the "Sola" Gas-Fire.

SIR,—In the "JOURNAL" for Nov. 11, Mr. H. S. Valentine made an inquiry regarding the significance of figures in the certificate which we have recently made public.

In answer to a similar inquiry from Professor W. A. Bone, we wrote: "We, therefore, have refrained, in all our published statements regarding the 'Sola' gas-fire, from quoting an absolute percentage radiation

efficiency, and have contented ourselves with showing the remarkable percentage *increase* in efficiency found when the 'Sola' gas-fire has been independently and carefully tested against our own 'Carlton' fire. We are confident, however, that independent tests will also show the marked radiation superiority of our 'Sola' gas-fire over other fires."

WILSONS AND MATHIESONS, LTD.

Armley, Leeds, Nov. 20, 1913.

P.S.—We regret that, owing to missing the latest posting time, this letter was not inserted in last week's issue.—W. & M.

The Retort Plant at Kilmarnock.

SIR,—I observe in your "Notes from Scotland" in your issue of the 18th inst. that there is a sentence which runs as follows: "Evidence is to hand that these verticals are in contemplation in Kilmarnock, where there is a talk of scrapping the horizontals and electrically driven charging machinery at a comparatively early date."

This statement is wrong. The Kilmarnock Corporation are up to the point of finding it necessary to increase their carbonizing plant; but they have no intention of scrapping any of their existing horizontal retorts.

I trust you will make this correction in your first issue.

CHAS. FAIRWEATHER, Joint Manager,
Kilmarnock Corporation Gas Department.

Kilmarnock, Nov. 22, 1913.

Heating and Ventilating of Public Halls, &c.

SIR,—Anyone who visited the National Gas Exhibition at Shepherd's Bush could not fail to be struck by the rapid advance made in the scientific construction and the æsthetic appearance of gas-fires. The wholly interesting and convincing lectures of Professor Lewes, followed recently by those of Mr. Hartley and Mr. Yates and the clear teaching of the leading articles of the "JOURNAL" itself, have all shown that, in constructing gas-fires mainly on the basis of radiant heat, the gas industry is working on a foundation of solid scientific security. As if to point the moral more clearly, it was obvious to anyone who frequently attended the lectures given at the exhibition that the lecture hall suffered from bad and inefficient heating, and from draughts amounting almost to a gale—the cause of many of the audience leaving before the lecture was well started. The heating apparatus installed, remarkable for the absence of radiating fires, was either silently ineffective or else noisily obtrusive.

May I venture then to ask you a question suggested by the consideration of these facts? What is the attitude of the industry, as a whole, towards heating and ventilation (for the two must go together) on a large scale? In workshops, public halls, churches, &c., are we to have convection systems or a series of many radiating fires? Can gas men go back on their principles of radiant heat, and recommend and instal so-called gas-radiators, gas-heated water systems, &c., which depend entirely on the principle of convection so much condemned by Professor Lewes? The answer to this question must be of paramount importance to all, if gas engineers are to maintain their position, and progress further in the profitable field of heating and ventilation.

B.Sc.

Nov. 19, 1913.

[The principal part of our correspondent's letter is the very fair question as to what is the attitude of the gas industry as a whole towards heating and ventilation on a large scale—in workshops, public halls, churches, &c. The lecture hall at the National Gas Exhibition was not a fair example to take. It was a hall erected within a building; and the manner of ventilating was due partly to structural difficulties owing to the character of the old building, and partly to being compelled to comply with the requirements of the London County Council, whose demands are law, whether or not they are always reasonable. In replying to the question as to the suitability of any one system of heating and ventilation over another, regard must be had to the character of the place. We are agreed that radiant heat is the proper thing in ordinary dwelling or closely confined rooms, and not a system of convected heating. When we come to halls of large cubical capacity, with considerable air space, many air-inlets, and, as a rule, many air-outlets, then the objections to the use of convected heat (which would apply to small rooms) have not the same weight; and, as a matter of fact, we do not think that such places as halls or churches of considerable cubical capacity, could be, for the purposes to which they are applied, adequately heated without the use of a convected-heat method at several points. We do not believe that Professor Lewes has any rooted aversion to the use of such a method in large halls or churches, provided that the flueless type of gas (so-called) "radiator" is not used. In halls of the kind under consideration, the ventilation cannot be assisted much by the ordinary provision made for heating; but one of the best and most effective means is the use for the general lighting, and to promote ventilation, of the multiple inverted burner ventilating gas-lamp. There are many halls now fitted with these; and the result has been, and is, most agreeable atmospheric conditions. One of these burners is now in use at the Royal Society of Arts; and a paragraph referring to it appears on another page.—ED. J.G.L.]

A woman at Newport (Mon.), who was subject to fainting fits, was found dead from gas poisoning on a chair in her scullery. The tap of a stove was turned on, but the gas was not lighted; and it was concluded that after turning on the tap deceased came over faint, and sat down without either lighting the gas or shutting off the supply. The Jury at the inquest returned a verdict of "Accidental death."

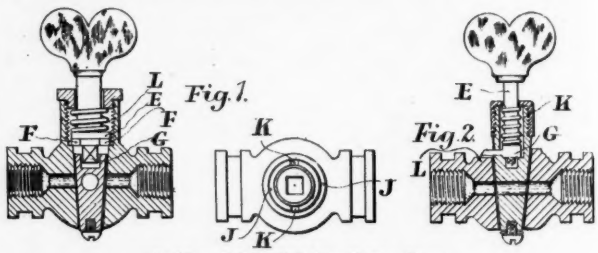
REGISTER OF PATENTS.

Preventing Accidental Opening of Gas-Cocks.

MICKLEWRIGHT, H. D., of Birmingham.

No. 24,276; Oct. 24, 1912.

This invention consists essentially in the combination with a screwed cap of a locking device wherein the body of the valve is formed with a concentric surface provided with recesses into which key bits formed on the lower end of the tap shank are adapted to fit when the actuating handle is in the "off" or closed position.



Micklewright's "Safety" Gas-Taps.

Fig. 1 is a sectional elevation of a cock fitted with one form of the invention; also a plan of the body of the valve showing the slots for retaining the actuating handle in the closed position. Fig. 2 represents a modification in which the valve plug and tap shank are coupled together by the cap or cover for the spring, and in which the locking pin is arranged externally to enter side grooves formed in the upper surface of the valve body.

In fig. 1 the body of the valve is shown, provided with an internally screwed neck adapted to receive a cap through which passes the tap shank. Secured to the lower end of the shank is a flange E, provided with key bits F and a projection G engaging with a similar shaped recess in the valve plug. Formed on the body of the valve is a concentric surface J, provided with recesses K into which the key bits are adapted to fit when the actuating handle is in the "off" or closed position. Pressing upon the flange E and the undersurface of the cap there is a spring L, which normally tends to force the key bits into the recesses.

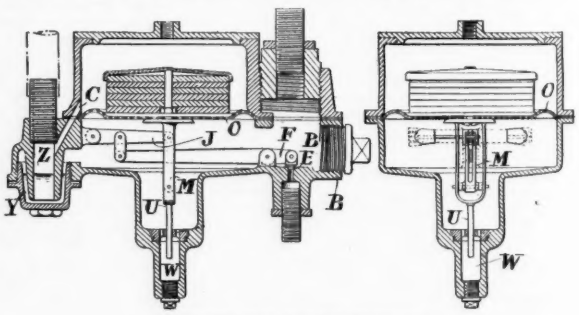
In the modification shown in fig. 2, the shank E is provided with an enlarged portion G with a projecting piece or cross pin formed on it, protruding through a vertical slot in the cylindrical portion of the tap body. The outer end bears upon a surface L provided with a recess (not shown) within which a cross-piece is adapted to be engaged when in the "off" or closed position, thus necessitating the pulling of the handle against the action of the spring K.

Fluid-Pressure Governors.

MITCHELL, E. A., of Broad Street Avenue, E.C.

No. 25,147; Nov. 2, 1912.

This invention relates to gas service governors, wherein the opening and closing of a valve at the inlet to a casing is controlled by the movement of a diaphragm—a movement diminishing and power increasing linkage system being disposed between the diaphragm and the valve.



Mitchell's Gas-Service Governor.

The governor case is of cylindrical form, with an extension or pocket B at one side and provided with a lower inlet branch and an upper outlet branch in alignment with it. The valve E, controlling the inlet, is positively connected to the shorter arm F of a double-armed lever forming part of a compound lever system, attached (through a link) to a subsidiary lever J, movable at one end about a stationary pivot, and connected at the other end through a bifurcated link M to a cradle positively attached to the underside of the diaphragm O, provided externally with adjustable balance-weights to enable the reduced pressure of the gas delivered by the governor to be varied.

In order to guide the diaphragm, the cradle attached to the underside of it may be provided with a stem U adapted to work in a spider disposed at the top of a pocket W towards which the bottom of the casing has a gradual fall. This pocket acts to trap moisture, and is provided with a removable plug after the manner of a drain box.

At a suitable point—say, diametrically opposite to the inlet and outlet—a sealed outlet Y is provided; the arrangement being such that, should the pressure exceed a predetermined value, mercury or the like in the seal will be forced up a tube Z and thus permit the gas to escape

to the atmosphere external to the room or space in which the governor is placed. In a similar way, in order to conduct gas to the external atmosphere should the diaphragm become ruptured, a passage C is provided in the upper casing leading to the tube Z.

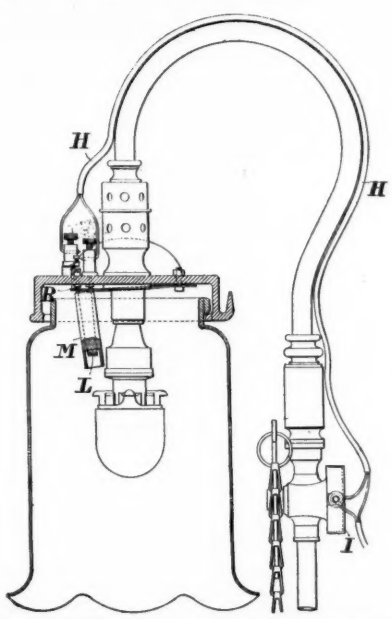
Electric Igniting Means for Gas-Burners.

SOUTH METROPOLITAN GAS COMPANY, and SOMERVILLE, J. M., of Old Kent Road.

No. 26,156; Nov. 14, 1912.

The patentees remark that means for igniting gas-burners electrically frequently comprise a wire or filament which is heated by the electric current so as to ignite the gas. In such means the circuit may be normally interrupted, and only closed by a switch actuated by turning on the cock which supplies the gas. The filament having been heated by the passage of an electric current from any suitable source, when the circuit is closed and the gas ignited, the circuit has again to be broken. This may be effected in various ways – for instance, by means of a thermostat which is acted on by the heat of the ignited burner and caused to make an interruption in the circuit independently of the gas-supply cock, which still remains open, until turned off in the ordinary way.

In apparatus of this description, it is essential to provide against premature corrosion of the igniting filament—particularly in the case of inverted gas-burners where the filament is placed in the zone of the products of combustion. According to their invention, therefore, the filament is placed in an inverted cup of refractory material which acts as a protection from the fumes of the burner which would tend to corrode, and ultimately destroy, the filament. "The fumes do not appear to enter the open mouth of the inverted cup, but pass away outside it, although it is placed in the course of the products of combustion very near the mantle." When the gas is turned off, and the burner extinguished, the thermostat must return to its initial condition, and the circuit broken by its movement must be immediately remade, so as to be ready to act again, as before, when required to relight the burner when the cock is again turned on thereby completing the circuit at the switch.



Somerville's (South Metropolitan Gas Company) Electric Ignition for Gas-Burners.

It is remarked in the specification that, in order to be satisfactory, the apparatus must be (in the phraseology of the trade) "fool-proof"—that is to say, it must be incapable of going wrong or of causing an accident, even in the hands of ignorant or careless persons. The apparatus described will, it is said, be found to meet the requirements of the case. "It will be sufficiently durable and it will be prompt in action. Promptitude in action is essential, particularly where a burner has been extinguished and requires to be relighted after a short interval. If the thermostat does not recover rapidly from its heating and the circuit does not become quickly re-established at the point controlled by the thermostat, there is delay in ignition when the gas is turned on after a short interval of extinction, and an escape of gas results, and ultimately an explosion."

A sectional elevation is given of the arrangement of the burner, which is connected by the cable H with an electric battery (not shown). The cable contains two insulated conductors leading to the switch I, and thence to terminals in the lamp top. One terminal connects direct with one end of the filament L, which has a coil situated in an inverted cup or crater M of fire-proof material. The other terminal has attached to it a metal spring carrying the adjustable contact screw and a pin. The screw is adapted to touch an insulated button which is electrically connected with the opposite end of the filament; while the pin projects through a hole in the lamp top into close proximity with the end of the thermostat bar R which is attached to the opposite end by a pin to the underside of the lamp top.

The casing of the switch carries two terminals (one of which is insulated) for the attachment of one of the conductors and to break the continuity of same. The circuit from the battery is normally broken at the switch; but when the gas is turned on, the circuit is completed and the current passing heats the filament I sufficiently to ignite the burner. The heat from the burner acts on the thermostat (which is made preferably in dished or hollow form of two metals which expand unequally – for instance, nickel and aluminium) and causes it to lift the spring and break the circuit. Thus the current is cut off and the filament ceases to glow. When the gas is turned off and the lamp is extinguished, the thermostat resumes its previous position. The contact becomes broken at the switch, and re-established at the screw, so that all the parts are ready for the next ignition.

Coin-Freed Gas-Meter Mechanism.

HIBBERT, C. E., of Tooting Bec., S.W., and GOAD, F. L., of Edinburgh.

No. 24,525; Oct. 26, 1912. No. 4574; Feb. 22, 1913.

This combined invention relates to coin-freed prepayment mechanism "of the type in which the commodity purchased—*e.g.*, gas or electricity—is delivered over a period of time;" and the main objects of the invention are "to facilitate the assemblage of apparatus of this type, to lessen its cost of manufacture, to reduce possibility of fraud, and to ensure greater accuracy of registration."

The chief features of novelty constituting the invention, and applicable either to a coin-freed mechanism in its single or multi-coin form (or both) are summarized as follows by the patentees: (1) A coin-pocket in which a coin is supported at two points when in its operative position—the one point of support being disposed at or near the axis of the coin-pocket spindle, and the other on a peripheral rail at a distance from the first point only slightly less than the diameter of the coin. (2) A single coin-pocket which can be brought into register at will with any one of a plurality of coin-inserting slots; successive sectors of movement of the pocket being preferably appropriated to coins of different metal. (3) A prepayment mechanism for coins of different value, in which, to provide for different diameters, a coin in its coin-pocket is supported or rides on rails or equivalent members which are at a varying distance apart, and, it may be also, of a varying height.

The invention likewise consists in improved coin-freed mechanisms and meters or other apparatus fitted therewith, as described by close reference to three sheets of lettered detail drawings, for the reproduction of which unfortunately we have no space.

Utilizing Exhausted Gas-Purifying Material.

MADSEN, C. J. H., of Copenhagen.

No. 12,833; June 2, 1913. Convention date, June 7, 1912.

The object of this invention is to provide a process for the direct utilization of the complex cyanogen compounds contained in exhausted gas purifying material, by working up the compounds together with the other constituents of the purifying material—such as sulphur, ferric hydroxide, &c.– by mechanical treatment into colouring matters "having a suitable combination colour." Experiments which have been made have, it is said, shown that the sulphur, the quantity of which frequently amounts to half of the entire material, does not impede the manufacture of a good pigment. Furthermore, exhausted gas purifying materials from which the sulphur has been removed by extraction can also be used as raw material in the manufacture of colouring matters according to this invention.

The treatments to which the materials are accordingly subjected are washing, levigation, grinding, drying, and similar treatments of the usual kind; the order in which the treatments are carried out and the plant employed for the purpose depending upon the different working conditions.

An example of a suitable method of wet treatment of the purifying material is as follows: The exhausted purifying material is first reduced to a fine state of sub-division and then stirred up in a levigating apparatus with the necessary quantity of water. The coarser parts remain at the bottom, while the levigated finer portions are collected in a tank or introduced directly into a mill suitable for wet grinding. The ground product is separated from the coarser grains by a second levigation, and the fine colouring matter obtained is freed from water in settling tanks, centrifugal drums, or the like, and finally finely ground in suitable machines.

The wet treatment has the advantage, it is claimed, that the water-soluble compounds—such, for example, as the poisonous ammonium rhodanate present in the purifying material—can be directly removed. Dry treatment must be preceded by washing with water. The washed purifying material is then dried at a suitable temperature, finely ground in ball mills or other disintegrating machines, and the fine colouring matter separated from the coarser grains in sifting machines, air separators, or the like.

As already stated or implied, the kind of treatment necessary depends on the origin of the gas purifying material and the working process of the different gas-works. Upon this will depend also the colour of the colouring matter produced which is sometimes deep blue, sometimes olive green, and sometimes brown. The colouring matter produced may be used for oil and water colours, distempers, printing inks, &c.

Gas-Poisoning Fatality at Belfast.—At an inquest held in Belfast, the Jury returned a verdict of "Death from gas poisoning" in the case of Wm. and Catherine Dickson, husband and wife, whose bodies were discovered in their house in Israel Street on the 14th inst. It was stated in evidence that the deceased were last seen on the 7th inst. On the 14th a neighbour, detecting a smell of gas, had the house entered, and, on going upstairs, found the bedroom filled with gas and the tap turned on. The man and woman were both dead. James Johnston, a Corporation gas official, said the gas-fittings were in good order. Sergeant Kincaid said a cloth had been nailed over the fireplace, so that the gas could not escape. Professor Symmers expressed the opinion that death had taken place a week before the discovery.

PARLIAMENTARY INTELLIGENCE.

PROJECTED GAS LEGISLATION FOR LONDON AND THE SUBURBS.

The notices which have appeared of intended applications to Parliament next session for additional powers include three by London and Suburban Gas Companies, which are so important as to justify their being dealt with more fully than is done in the usual epitome which appears on pp. 691-2.

Gaslight and Coke Company and a British Thermal Unit Standard of Calorific Power.

The Gaslight and Coke Company intend to apply for an extension to their entire area of supply of the provisions in regard to calorific power which are at present applicable in only part of it. The notice is so important that we give it practically *in extenso*. The objects of the Bill are as follows:

To provide that (subject to such variations, extensions, and alterations as are hereinafter mentioned, or as may be specified in the Bill) all or some of the provisions relating to the standard calorific power of the gas supplied by the Company and to the testing for such power, and the provision and maintenance of apparatus therefor, and to penalties for deficiency in such power, which are now in force with respect to a part or parts of the area of supply of the Company, shall extend to and apply in that part—consisting of the parishes of Barking, Dagenham, Ilford (except the Great Ilford Ward), Chigwell, Loughton, Chingford, Buckhurst Hill, and that part of Woodford which was formerly in the area of supply of the Chigwell, Loughton, and Woodford Gas Company—of the area of supply of the Company with respect to which the said provisions do not now apply.

To substitute a new standard calorific power of the gas supplied by the Company for the existing standard prescribed by section 39 of the Gaslight and Coke Company's Act, 1909, and to define such substituted standard in terms of British thermal units gross per cubic foot, instead of in terms of calories net per cubic foot, and (if thought fit) to prescribe as such substituted standard a number of British thermal units gross which may be less than the equivalent of the said existing standard, and to make all such consequential alterations in the said section 39 as may be thought fit with respect to the circumstances in which a second testing of the gas supplied by the Company shall be made on any day, and if and so far as may be deemed necessary or expedient to vary section 42 of the Act of 1909 and section 5 of the London Gas Act, 1905.

To amend sections 40 and 41 of the Act of 1909 by substituting such a number of British thermal units gross (whether equivalent to or less than the equivalent of the quantity expressed in calories net as specified in those sections) as may be prescribed by the Bill as the quantity for determining the liability of the Company to penalties in respect of defective calorific power; and to make all such consequential alterations in the scales of penalties prescribed by those sections as may be thought fit.

To relieve the Company from every obligation to which they are now subject as to supplying gas of a prescribed illuminating power, and (except as hereinafter mentioned) from all liability or obligation to provide or maintain apparatus for testing such illuminating power, and from all liability to penalties for deficiencies of such illuminating power; and to provide for the testing of the quality of the gas supplied by the Company by reference to its gross calorific power alone, instead of to its net calorific and illuminating power or (as regards the parishes hereinbefore specifically mentioned) its illuminating power.

To repeal, alter, or amend every or any enactment imposing any such obligation or liability as aforesaid, and in particular (but without prejudice to the generality of the foregoing statement) to repeal, alter, or amend all or some of the provisions of the Gas-Works Clauses Act, 1871, and of the enactments next hereinafter mentioned, so far as they relate to the illuminating power of the gas supplied by the Company, or (except as hereinafter mentioned) to the provision, maintenance, or user of testing-places or apparatus for testing illuminating power, or to the making of such tests, or to reports of the results of such tests, or to deficiencies in such illuminating power, or penalties for such deficiencies, or to the powers of the Metropolitan Gas Referees with respect to the making or giving of prescriptions or certificates, or to any other matter having reference to illuminating power or incidental to or connected with any of the matters hereinbefore mentioned.

The enactments are the following (that is to say): The Gaslight and Coke Company's Act, 1876, secs. 27 and 34; the Gaslight and Coke and Other Gas Companies Acts Amendment Act, 1880, secs. 7, 8, 10, 13, 14, and 17, so far as they apply to the Company; the Scheme for the Amalgamation of the London Gaslight Company with the Gaslight and Coke Company, confirmed by Order in Council, dated May 22, 1883, sec. 39; the West Ham Gas Act, 1902, sec. 33.; the London Gas Act, 1905, secs. 3, 4, 5, 9, 12, and 14 so far as they apply to the Company; the Act of 1909, secs. 17, 18, 19, 38, 43, and 44; the Gaslight and Coke Company's Act, 1911, sec. 20.

The intended Act will vary, repeal, or extinguish all existing rights, powers, and privileges which would in any manner interfere with, or prevent the carrying into effect of, any of the objects of the intended Act, and will confer other rights, powers, and privileges.

Amalgamation Scheme of the Brentford Gas Company.

Important powers will be sought by the Brentford Gas Company. In the first place, they wish to consolidate and convert their issued and unissued capital into stocks bearing the same or lower standard or initial rates of dividend; and there will be a consequent increase of the nominal capital. Authority will be sought (*inter alia*) for the amalgamation of the undertaking with those of the Staines and Egham District Gas Company and the Sunbury Gas Company, and for the exercise by the purchasing Company of all the powers vested in the other Companies. The provisions of the Brentford Company relating to the illuminating power of the gas, testing burner, sliding-scale, standard price, and other matters are to be extended to the acquired areas. The powers of the Uxbridge Gas Company to supply gas within the parish of Harlington and a portion of the parish of Stanwell are to be repealed. Authority will be sought for the Brentford Company and the Egham and District Electric Light Company, Limited, to enter into an agreement for the transfer of powers under the Staines Electric Lighting Order, 1909, in respect of the whole or a portion of the area of supply under the Order, and the whole or a portion of the undertaking thereby authorized; and also for the Brentford Company to apply for Provisional Orders to supply electrical energy, and to take transfers of the undertakings of local authorities and others. Provision will be made for the application of the Company's funds for the purpose named, and for the keeping of separate accounts of the gas and electricity undertakings. Among the other proposals for which sanction is required is one for the supply of power gas, and another is the fixing of the salary of the Secretary by the Directors.

Extensions by the South Suburban Gas Company.

The South Suburban Gas Company will apply for power to construct at Erith a wharf, jetty, railway siding, and incidental works. The lands south of the intended wharf are to be levelled and appropriated. Lands are to be acquired at Erith, and authority will be sought to use them for the manufacture of gas or electrical energy and residual products, and to enter into contracts for the sale or supply of any energy they may not require. The Company will ask for authority to purchase, by compulsion or agreement, any mines or minerals under lands taken by them. The Bill will contain a provision enabling the Company on the one hand and the Erith Urban District Council on the other hand to enter into and carry into effect agreements for and with respect to the provision of a testing-place in substitution for the one referred to in section 48 of the Company's Act of 1912, and in connection therewith to repeal, alter, or amend all or some of the provisions of the section. Certain stock-conversion proposals will be included in the Bill.

FURTHER POWERS FOR THE LIVERPOOL GAS COMPANY.

A Calorific Value Standard.

The Liverpool United Gas Company have given notice of their intention to apply to Parliament next session for additional powers, the nature of which will be gathered from the following particulars.

The Company wish to be authorized to extend their limits of supply so as to include the parish or township of Childwall, in the urban district of Childwall, the parish or township of Little Crosby, in the urban district of Little Crosby, and the parishes or townships of Aintree, Netherton, Sefton, Lunt, Ince Blundell, and Thornton, in the rural district of Sefton, all in the county of Lancaster, or one or more of them, or some part or parts thereof respectively, and to apply within the new limits, with or without exceptions or modifications, all or some of the provisions of the Acts relating to the Company. They also desire to be empowered to purchase by agreement the gas-works and the site thereof, and the mains, pipes, and plant used for the supply of gas, situated in the urban district of Childwall, and belonging to the Marquis of Salisbury, or any part thereof, for such price or consideration, and upon and subject to such terms and conditions, as may have been or may be agreed between the Company and the Marquis, or may be expressed in or provided for by or under the provisions of the Bill to be promoted. They will ask Parliament to confirm and give effect to any agreement between them and the Marquis with reference to any such purchase which may have been, or may, prior to the passing of the intended Act, be entered into; and to authorize them to maintain, alter, and generally deal with any mains, pipes, works, or plant, and also the site, so acquired.

It is proposed to consolidate or convert the existing capital, and authority will be sought for raising more. The Bill will contain provisions with regard to dividends and the adoption of the sliding-scale, with or without a neutral zone. The present maximum price of gas is to be repealed, and a standard price or prices substituted. The financial provisions of the Bill will include power to create special purposes and reserve funds.

Authority will be sought by the Company to make further provision with reference to the testing, quality, purity, and pressure of their gas, and the instruments to be used for such testing. They wish to be relieved from all obligations relating to the maintenance of a standard of illuminating power, and from all restrictions upon, and obligations as to, the amount of sulphur or sulphur compounds in the gas, and from liability to penalties or forfeitures by reason of the insufficiency or otherwise of its illuminating power, quality, or purity, or of the presence of sulphur or sulphur compounds (other than sulphuretted hydrogen), and in the case of circumstances beyond their control. If thought fit, a calorific standard will be prescribed.

Provision will be made for changing the name of the Company to the "Liverpool Gas Company," or such other as may be defined in the Bill or prescribed by Parliament; for reducing the number, qualification, remuneration, &c., of the Directors; for holding only one general meeting in the year, and the payment of interim dividends; for laying down pipes for procuring, conducting, or disposing of oil or other materials or residual products; for the sale of gas in bulk and the supply of fittings, &c.; for fixing the charge to be made for gas supplied through prepayment meters; for the fixing and inspection of pipes and fittings, &c.

DUBLIN GAS COMPANY AND ELECTRICITY SUPPLY.

The Alliance and Dublin Consumers' Gas Company have given notice of their intention to apply next session for power to supply electricity. The following are the principal features of their scheme.

The Company require authority to generate, store, and supply, either in bulk or otherwise, electric energy for public and private

purposes within an area comprising the urban districts of Blackrock, Kingstown, and Dalkey, in the county of Dublin, and to make and recover charges in respect thereof. Certain lands now held by the Company at Old Dunleary are to be utilized for the construction of the generating station; and authority will be sought to use any other lands held or occupied by them within the proposed area of supply. The Company wish to be empowered to enter into contracts or make arrangements with any local authority, company, body, or person for the supply, either in bulk or otherwise, of electric energy, plant, fittings, and materials to them, or by them to the Company; also to manufacture, purchase, sell, and let on hire engines, machinery, wires, lamps, meters, fittings, &c., connected with the production, distribution, and utilization of electricity. The Bill to be promoted will contain provisions enabling the promoters to open streets for laying the wires and erect the necessary posts and apparatus for distributing the current, fix and define the maximum price to be charged, and prescribe differential prices. The Company will ask to be relieved from obligations to supply in such circumstances as may be defined by the Bill, and particularly in cases where the consumers have a supply of power or lighting separate from that provided by the Company, and in cases where consumers are indebted to the Company for gas or electrical energy in respect of the premises to be supplied, or of other premises, at which the consumer may have been receiving a supply either of electrical energy or gas.

The Company wish to be empowered to apply their capital and funds to and for the purposes of the intended Act; but they will ask for authority to provide separate capital for the new undertaking, and to be relieved of any obligations with respect to the sale by public auction of shares or stock in such capital. The new capital is to be raised by debenture stock or debentures charged upon the undertaking, or, by way of collateral security, upon the gas undertaking; but not so as to prejudice in any way the holders of similar securities in that undertaking. Separate accounts are to be kept of the two branches of the Company's business.

The Blackrock Electric Lighting Order, 1901, is to be repealed, and the Company will take over the powers conferred by it upon the Blackrock Urban District Council. The Company wish to be authorized to make agreements with parties for the acquisition of any powers with regard to electricity supply which they may possess or be applying for, and for the transfer to the local authorities of the several districts affected by the Act of the undertaking to be sanctioned by it.

NOTICES GIVEN FOR BILLS (SESSION 1914) RELATING TO GAS, ELECTRICITY, AND WATER SUPPLY.

[First List.]

Abertillery and District Water Board.—The Abertillery and District Water Board intend to apply for authority to construct a new reservoir in the parish of Llanelieu, in the rural district of Hay, in Brecknockshire, and alter the existing provisions in regard to compensation water. Certain sections of the Board's Act of 1910 are to be amended. Additional borrowing powers are required.

Alliance and Dublin Consumers' Gas (Electric Supply, &c.).—The Alliance and Dublin Consumers' Gas Company intend to apply for power to supply electricity. The principal features of the notice they have given in regard thereto are dealt with on p. 690.

Brentford Gas.—The Brentford Gas Company purpose applying for important additional powers, which are noticed on p. 690.

British Gaslight Company.—Authority will be sought by the British Gaslight Company, Limited, to expend further capital in connection with their Hull station, and to supply gas in bulk within or beyond their limits.

Chelmsford Gas.—The Chelmsford Gas Company wish to be dissolved and reincorporated with increased capital and borrowing powers. The Bill to be promoted will contain provisions to sanction the creation of reserve and special purposes funds, the maintenance of the existing works and the construction of new ones, and confer the usual powers incidental to the supply of gas. The Company will apply for authority to make superannuation allowances and to pay pensions to their employees; also to institute a co-partnership scheme.

Cleckheaton Urban District Council.—The Cleckheaton Urban District Council intend to apply for authority to acquire the portion of the undertaking of the Bradford Corporation which is situated within the hamlets of Scholes and Oakenshaw, and extend their limits of supply. It is proposed to ask for the repeal of the powers of the Gomersal Gas Company to supply gas in parts of Gomersal and Hunsworth, and those of the Heckmondwike and Liversedge Gas Company in respect to a portion of Liversedge. The Bill will contain the usual provisions with reference to the supply of gas; and additional borrowing powers will be required.

Edenbridge and District Gas.—The Edenbridge Gas Company, Limited, will seek to be dissolved and re-incorporated; and the Bill to be promoted to sanction the change will contain the necessary financial provisions. Authority will be required to supply gas in the parishes of Edenbridge, Chiddingstone. Cowden, Hever, and Westerham, parts of Penshurst, and Brasted, in the county of Kent. Provision will be made for the maintenance and extension of the existing gas-works and the construction of new ones, the manufacture and supply of gas and residual products, the regulation of pipes and fittings, and the sale of gas in bulk. It is proposed to ask for an amendment of the Gas-Works Clauses Act, 1871, so that in its application to the Company it shall be construed as if calorific value were referred to in lieu of illuminating power.

Gaslight and Coke Company.—The notice given by this Company is dealt with on p. 690.

Haywards Heath Gas.—The Haywards Heath District Gas Company intend to apply for an extension and definition of their limits of supply, and the repeal of restrictions in the exercise of powers in the urban district of Cuckfield. The Bill to be promoted will include provisions in regard to the consolidation of capital, dividends, the adoption of a sliding-scale, the testing of gas, the charge for supplies through prepayment meters, &c. More capital will be required.

Isle of Thanet Gas.—The Isle of Thanet Gas Company will apply for power to acquire the whole or part of the undertaking of the Broadstairs Gas Company, and supply gas in their district. Authority will be sought to maintain and extend the existing works and construct others. Provision will be made in the Bill for the testing of gas for heating and not illuminating power, and for the amendment or repeal of the Thanet Gas Acts so far as they relate thereto. Additional share and loan capital will be required. Other matters to be dealt with in the Bill are the remuneration of the Secretary, the appointment of officers, the granting of superannuation allowances, and the introduction of profit-sharing.

Kidsgrove Gas.—The Kidsgrove Gas Company intend to apply for an alteration of their limits of supply so as to include the parish of Odd Rode, in the rural district of Congleton, and exclude part of the parish of Audley, in the county of Stafford. The existing limits will be defined in the Bill; and it is proposed to ask for the repeal of the powers of the British Gaslight Company to supply gas therein. Authority will be sought for the purchase of additional lands and for the erection of gas-works theron. The Bill will contain provisions in regard to the extension of the existing works; the construction of a bridge, with rails and works, over the Trent and Mersey Canal; the adoption of the sliding-scale, with standard prices for gas; the alteration of the provisions of the Company's Act of 1871 with respect to the testing of gas and the prescription of a new burner; and the establishment of a profit-sharing scheme. Additional capital and borrowing powers will be required.

Leeds Corporation.—In a General Powers Bill for which notice has been given by the Leeds Corporation, authority will be sought for the construction of additional water-works, comprising a covered service reservoir in the township of Brodsworth, in the rural district of Doncaster, and four conduits or pipe-lines; for making agreements with the Doncaster Corporation for the supply of water to them; and for empowering this Corporation to execute all or any of the works specified, and to raise the necessary money. It is proposed to ask for an extension of the limits of supply of the Leeds Corporation so as to include a number of townships in the Doncaster rural district and the Tickhill urban district.

Leighton Buzzard Gas.—Authority will be sought by the Leighton Buzzard Gas Company for an extension of their limits of supply so as to include Grove, Mentmore, Slapton, and Wing, in the county of Buckingham, and Billington, Eggington, and Stanbridge, in the county of Bedford. It is proposed to consolidate and convert the existing capital; and the Bill to be promoted will contain provisions in regard thereto. Additional capital and borrowing powers will be required, as well as authority to make differential charges for gas, and adopt a sliding-scale of price and dividend. New provisions are required with regard to the illuminating power, pressure, quality, and testing of gas; and the Company will ask to be relieved from existing obligations and liabilities to penalties. They also wish to substitute a calorific for an illuminating power standard.

Leyland Gas and Electricity.—The Leyland Gas Company intend to apply for an extension of their limits, authority to substitute a calorific power for an illuminating power test of their gas, acquire additional lands, establish a benefit fund for the employees, reduce their capital, and make the dividends vary with the average price of gas. The boundary between the gas limits of the Company and the Preston Gas Company is to be defined or varied. The Company wish to be empowered to apply for Provisional or other Orders under the Electric Lighting Acts, 1882 to 1909, construct generating stations, supply electricity, and enter into agreements with the Lancashire Electric Power Company and local authorities in regard thereto; also to supply electrical fittings. It is proposed to change the name of the Company, and to apply for additional capital and borrowing powers.

Liverpool Gas.—The notice given by the Liverpool United Gas Company of their intention to apply for extended powers is dealt with on p. 690.

London, City of (Testing High-Pressure Gas-Meters).—In a Bill for which the Corporation of London have given notice they will ask for authority "to make provision with reference to high-pressure gas-meters tested or used, or intended to be tested or used, within the City, and to require such meters to conform to such standards and requirements as regards design, construction, index, and otherwise, as may be necessary for securing the accurate and reliable working and easy reading thereof; to provide for the efficient testing and periodical retesting thereof as regards soundness, leakage, and measurement or percentage of error, and in other respects add to, prescribe the mode of such testing, and the fees payable, and the form of certificate to be given in connection therewith, and to alter, amend, or repeal all or some of the provisions of the Sale of Gas Act, 1859; and make such other provision with respect thereto as may be expedient or the intended Act may provide."

Longwood and Slaithwaite Gas.—Application will be made by the Longwood Gas Company for authority to acquire the Slaithwaite Gas Company's property, and extend to the enlarged undertaking the existing provisions relating to each Company. It is proposed to alter the burner to be used for testing the gas, and to make further provisions with respect to illuminating power and quality. The name of the Company is to be changed. Power will be required to formulate a co-partnership scheme; and additional capital and borrowing powers will be applied for.

Lurgan Gas and Electricity.—The Lurgan Gas, Light, and Chemical Company, Limited, require authority to maintain and continue works and supply gas in the urban district of Lurgan and in parts of certain parishes in the counties of Armagh and Down. The Bill will contain the general provisions in regard to the supply of gas; but it is proposed to ask for the substitution of the calorific for the illuminating power standard. The Company wish to be empowered to generate and supply electrical energy within the urban district; and the Bill will contain all the provisions incidental thereto. The accounts of the two undertakings will be kept separate. The Company wish to be authorized to appoint a Managing Director. Additional capital will be required.

Manchester Corporation.—In a General Powers Bill of which the Manchester Corporation have given notice further provision will be made in regard to the sale of coke. The objects are to require the delivery of a weight ticket to purchasers, to enable officers of the Corporation, purchasers, and others to demand that coke shall be weighed; and to provide for the sale of small quantities of coke in properly labelled sacks, and for the application to it of certain provisions of the Weights and Measures Act, 1889, relating to coal. By the same Bill the Corporation will seek power to raise money for the purpose of obtaining a further supply of water from Thirlmere, and for other purposes connected with their water undertaking.

Mexborough Urban District Council.—Application will be made by the Mexborough Urban District Council for authority to purchase the undertaking of the Mexborough and District Water Company, improve the works, supply water and fittings, and raise money for the purpose. The Bill will contain general provisions with regard to the supply of water.

Reading Corporation.—A General Powers Bill to be promoted by the Reading Corporation will contain a clause to enable them to make further provision in regard to the charge for the supply of water, particularly where it is employed for washing carriages, motor-cars, or other vehicles, or is used in premises where these are kept, and to require that the supply shall be by meter.

Rhymney and Aber Valleys Gas and Water.—Application will be made by the Rhymney and Aber Valleys Gas and Water Company for authority to acquire additional lands at Bedwas for the construction of gas-works, and at Senghenydd for water-works purposes. Additional capital will be required; and the existing share and loan capital is to be rearranged. Provision is to be made for the alteration of the date of the half-yearly or general meetings of the Company, as well as in respect of the accounts and the payment of interim dividends.

Riddings District Gas.—The Riddings District Gas Company intend to apply for power to extend their limits of supply, so as to include certain specified portions of the parish of Pinxton, in the rural district of Blackwell, and the parish and urban district of Alfreton, both in the county of Derby, and of the parish of Selston, in the rural district of Basford, in the county of Nottingham. It is proposed to acquire the undertaking of the Pinxton Gas and Coke Company, Limited; and authority will be sought for the manufacture and storage of gas on the site of the works. The Company wish to be authorized to make further provision with respect to the testing and quality of the gas, and the substitution of a calorific for an illuminating power standard.

Sheffield Corporation.—The Corporation of Sheffield require authority to make provision for the better apportionment of the expenditure of the Derwent Valley Water Board, particularly with respect to the apportionment of all such expenditure as has been or may be incurred for the common use or benefit of all the corporations represented on the Board; to define what expenditure shall be deemed to have been, or to be, for such common use; to alter and amend certain of the provisions of section 85 of the Derwent Valley Water Act, 1899, with respect thereto; and to amend or set aside such part of any award, judgment, or other proceedings, as may be necessary to give effect to the purposes indicated.

Skegness Gas.—The Skegness Gas Company desire to be dissolved and reincorporated with the usual powers incidental to the supply of gas. The capital is to be defined and increased, the existing works are to be maintained, and their freehold site purchased. Provision will be made for testing the calorific value of the gas, either in substitution for, or in addition to, its illuminating value.

South Bank and Normanby Gas.—The South Bank and Normanby Gas Company will apply for authority to extend their limits so as to include a portion of Marton, in the rural district of Middlesbrough; and they will ask for the repeal of the powers now possessed by the Middlesbrough Corporation to supply gas in the Company's existing and extended limits. Further provisions are to be made with regard to the terms and conditions of supply and its discontinuance by the Company.

Southend Gas.—Application will be made by the Southend Gas Company for an extension of their limits of supply so as to include a number of parishes or places, or portions thereof, in the county of Essex. It is proposed to acquire by agreement the gas undertaking of the Southend Corporation at Leigh-on-Sea. Authority will be sought to raise further capital; also to alter and prescribe the illuminating power and the calorific value and mode of testing of the gas to be supplied by the Company, and, if thought fit, to substitute a standard calorific value for the prescribed illuminating power.

South Suburban Gas.—The notice given by the South Suburban Gas Company is dealt with on p. 690.

Stone Gas and Electricity.—The Stone Gas Company have notified their intention of applying for power to acquire additional lands for gas-works purposes, and to extend their limits of supply so as to include a portion of the parish of Stone Rural. It is proposed to alter the Company's Order of 1881 with respect to the quality, testing, and pressure of gas, substitute a standard price, with sliding-scale, for the present maximum price, form special purposes and reserve funds, establish a profit-sharing scheme, and make regulations for the supply of gas. The Company require authority to construct the necessary works to enable them to produce, store, and supply electricity throughout the parish and urban district of Stone and the parish of Stone Rural. The name of the Company is to be changed. Additional capital and borrowing powers in respect of the two branches of the undertaking will be required.

Tees Valley Water.—The Tees Valley Water Board intend to apply for authority to make a deviation of a conduit referred to in their Act of 1907, abandon part of it, and construct a service reservoir and three conduits or pipe-lines. Sanction will be sought for an extension of the Board's limits of supply to parts of the rural districts of Ormesby, Middlesbrough, Guisborough, and Stokesley. The provisions of the Act of 1907 in regard to the charge for water to large consumers are to be repealed, and others substituted; and the borrowing powers of the Corporations of Stockton, Middlesbrough, and Thornaby-on-Tees are to be enlarged.

Wadhurst and District Gas.—Authority will be sought for the incorporation of a Company to make and maintain works, and carry on the business of gas supply. Provision will be made for the transfer to the Company of the gas undertaking of the Ticehurst and District Water and Gas Company, and for the confirmation of any agreement made in respect of such transfer prior to the passing of the intended Act. The area of supply comprises Wadhurst, Ticehurst, Burwash, Salehurst, Hurst Green, Heathfield, and Etchingham, all in the county of Sussex. The powers sought are of the usual character; but application will be made for sanction to substituting a calorific for an illuminating power standard for the gas.

MISCELLANEOUS NEWS.

AN AUSTRALIAN WAGES AWARD.

In the Commonwealth Arbitration Court, on Sept. 23, Mr. Justice Higgins announced his proposed award on a claim of the Federated Gas Employees' Industrial Union against the Metropolitan of Melbourne, Brighton, and Hobart Gas Companies. The plaint was filed in May, 1912; and there were 52 claims. Originally the Geelong Gas Company also were cited; but proof failed that they were a party to the dispute. With regard to the majority of the claims, the Judge said he would probably not have to make an award, for the three Companies had consented to come to separate agreements with the Union embracing most of the subjects in dispute.

Mr. Justice Higgins said that, so far as the Metropolitan and Brighton Companies were concerned, there was no need to prescribe any great increase in existing rates of pay. Within the three years preceding the plaint, the wages of the yardmen in the Metropolitan Company had been increased from 7s. to 8s. per day, and those of the stokers from 8s. 6d. to 10s. 3d. (except at the West Melbourne works). In 1912, the Wages Board was split up, by Order in Council, into three parts, and one part, the Fuel and Fodder Board, for the Metropolitan district, fixed 9s. as the minimum wage, for a week of 48 hours, for yardmen in coke yards; and the Gas Company, having secured the aid of the shipping companies, appealed to the Court of Industrial Appeals, where the minimum wage was reduced to 8s. An Arbitration Court had, of course, to approach the subject of the minimum wage from a point of view different from that of a Wages Board or the Court of Industrial Appeals. It had primarily to settle disputes and promote peace in an industry; whereas the Wages Board was primarily to prevent sweating or under-payment. He was faced by the fact that various employers had agreed to pay more than 8s; and he also had to consider the fact that, in the recent award made in Sydney for three gas companies, by a Wages Board, the minimum for all yardmen, including coke-stage men, was 9s. There was, further, the admitted fact that the cost of living had increased. The basic wage fixed in 1907 at 7s. must be raised in places, leaving the Melbourne cost of living to 8s. a day at the very least, and in Sydney, where the cost of living was greater, it must be made still higher. In 1907, 7s. was worth as much in Melbourne, in the commodities which wages can procure, as 8s. 5½d. to-day; and this, if taken by itself, would suggest an increase to nearly 8s. 6d. It would seem to be proper, in dealing with a Melbourne undertaking, to follow the fluctuations in the Melbourne cost of living, and to give effect to the increase in cost since 1907. Besides, for some reason not quite clear to him, it appeared to be the practice, not only in Australia, but elsewhere, to give somewhat better wages to labourers in gas-works than in ordinary industries. On the whole, looking at the problem as an Arbitrator endeavouring to secure peaceful and willing work in the industry, and considering the finding of the two Wages Boards, and all the surroundings, he did not think that he could justly award less than 8s. 6d. per day. As for the stokers, he proposed to retain the same margin between the yardman and the stoker—2s.—as existed when the pay of both was considerably lower (7s. and 9s. in 1890). The difference of 2s. in the wages could not well be attributed to skill in the stoker—skill such as a trained artisan had. But the occupation of stoker involved special qualities of body and physical condition, and even character. If men were to be paid extra for exceptional skill, they were entitled to be paid extra for such exceptional bodily or other qualities as their occupation necessarily demanded. The Judge said it was evident to him that the men had been influenced in their claims by the handsome profits made by the Metropolitan Company, especially since the reduction in the price of coal and the introduction of the newest appliances. According to the recent Gas Inquiry Board, the cost per 1000 cubic feet of gas made had been reduced, between 1899 and 1911, from 3s. 6d. to 2s. 7d.; but the minimum wage must be primarily based on the needs and qualifications of the class of workers concerned—not usually on the affluence of the employer. Smaller companies could not effect the economies of the Metropolitan Company, and could not produce gas so cheaply. If the conditions and the merits of the class of workers were substantially the same in the several companies, he ought to prescribe the same minimum. Otherwise, if he increased the minimum by reason of wealth, he must reduce it by reason of poverty; and the very object of the minimum wage would be defeated. The result of what he had said was that the yardmen would get 8s. 6d. as a minimum, or 1s. 6d. per day more than when the Union was formed; and the stokers 10s. 6d., or 1s. 9d. a day more. These rates were higher, when the purchasing power of money was considered, than the 9s. and 11s. under the Sydney award; and it was gratifying to find that the men who had sought their remedy by arbitration had come off substantially better than the Sydney men who sought their remedy in a strike. He saw no reason why he should not prescribe the same minimum for the Brighton Company as for the Melbourne Company. But as in Hobart there was a slight difference in the cost of living, he prescribed in their case 8s. 3d. for the yardmen and 10s. 3d. for the stokers.

The full award, in the case of the Metropolitan and Brighton Gas

Companies for the minimum wages of members of the claimant organization is: Yardmen (including coke-stage men) and all other labourers, 8s. 6d. per day; stokers or firemen, 10s. 6d.; blacksmiths, 11s.; skilled labourers, 9s.; main and service layers' labourers, 8s. 9d. For the Hobart Gas Company, 3d. less per day in each case. "Skilled labourers" include tackle hands, strikers, men who erect staging or scaffolding, and men who put up or take down ascension-pipes in the retort-house. The award (which also makes provision for compensation for accidents) will operate for three years from Aug. 3 last. The agreements which have been arranged between the Companies and the employees deal with the conditions of labour. Among other matters, it has been arranged in the agreement with the Metropolitan Company that wages shall be paid in the Company's time; that ten days' leave of absence on nine days' pay be granted; and that Union notices may be posted in the messroom, and Union dues collected on the Company's premises. There is to be no discrimination against members of the Union. Special dressing-rooms, with baths and lockers are to be provided. Time-and-a-half is to be paid for Sundays and certain holidays, and double time for Christmas Day and Good Friday. Skilled labourers are to receive 6d. a day above the minimum, bridge men a proportionate increase, and conveyor men 1s. less and trimmers 1s. 6d. less per shift than stokers.

Mr. Justice Higgins, in concluding his remarks, said he had received on behalf of the men an undertaking that they would loyally work under the award, whatever it might be; and he pointed out that any resistance to the claims of the Union on the part of the Companies was attributable to the sense of duty towards the shareholders entertained by the Managers and Directors.

USE OF SUBWAYS IN LONDON.

Proposed Revision of Charges by the London County Council—Objections by the Commercial Gas Company.

At the Meeting of the London County Council to-day, the Highways Committee will present a report on the subject of a proposed revision of the charges to be made to gas and water companies for the use of the subways under their control.

The Committee point out that in December, 1895, the Council, under powers conferred by section 10 of the London County Council (Subways) Act, 1893, made bye-laws relating to the use of their subways, and these were subsequently approved by the Board of Trade. Included therein was a schedule of annual charges to be paid by gas and water companies and other bodies and persons. In June, 1907, the Council made amended bye-laws, and fixed a revised scale of fees, which were submitted to the Board of Trade for approval. Subsequently, however, the Committee had under consideration the question of making a uniform scale of charges in respect of all works in the subways, including those of the electric lighting undertakers; and they revised the charges on the basis of higher payments by users other than such undertakers. Pending the settlement of the proposed new scale, the Council withdrew the bye-laws which had been submitted to the Board of Trade in 1907. The Committee now propose a new scale of charges, which are set out in a table attached to their report. They are calculated on the basis of a percentage of the estimated saving in first cost due to the pipes being laid in the subways instead of in the streets. The Committee are advised that the Council have power to vary the charges made in respect of existing mains in subways, but that the Board of Trade would be unlikely to consent to the proposed charges being applied to such mains. Consequently, after careful consideration they are of opinion that these should relate only to new works—a main laid in substitution of an old one to come under this definition. The new scale was communicated to all users of the subways, and the Committee submit a summary of their observations thereon. Among them are those of the Commercial Gas Company, who deprecate any increase in the charges for the following reasons:

(1) The pipes are not placed in subways by any wish of the Company, and it is, in fact, questionable, in the opinion of the Company, whether it is desirable that pipes should be laid in subways, having regard to the risk of explosion in consequence of a leakage of gas occurring at any time; and there is always the possibility of a pipe breaking, or the joints being started, especially in intensely cold weather.

(2) While the Company is saved the expense of opening the ground by reason of its pipes being in the subway, there is extra expense in another direction owing to additional men being required when repairing or connecting service-pipes to the mains therein.

(3) If it is claimed that it is for the public convenience that subways should be constructed to avoid opening the roads as far as possible, it is not, in the Company's view, equitable that undertakers such as the Company should be specially called upon to bear additional expense as proposed; and, inasmuch as the subways are installed in old thoroughfares which are fully built upon, the occasions for the Company needing to make connections are very rare, so that the Company saves very little from the occupation of the subway.

The Gaslight and Coke Company, the South Metropolitan Gas Company, the Metropolitan Water Board, and the London Hydraulic Power Company did not offer any observations on the proposal The Postmaster-General, however, remarked that, as he had a statutory right to the use of the subways for his telegraphs, he could not agree to the payment of any charges which covered more than the cost of supervision, or were calculated on a different basis. The Committee point out that, except in two cases, none of the users of the subways have made any observations upon the proposed revised charges. They say they are advised that the Commercial Gas Company are very small users of the subways, and, owing to the length of those in their area, are not likely ever to become large users. They therefore think that, in the circumstances, the Council are justified in asking the Board of Trade to approve the charges; and they recommend accordingly.

THREATENED GENERAL STRIKE AT BLACKBURN.

A strike of Corporation employees seems imminent at Blackburn. Some time ago, the Gas Workers and General Labourers' Union requested the Corporation to institute certain reforms for the benefit of workers engaged in practically all the departments. These included:

Lamp Department: Labourers, an increase of ½d. per hour (including those occupied in lamp lighting). To men described as lamplighters only, an increase of 1s. per week. All men in the Lamp Department to be provided periodically with jackets and caps. Water Department: An increase of ½d. per hour, with a minimum of 6½d. Overtime rates: Time and a quarter for the first two hours, and time and a half for subsequent hours. Week-end overtime: Extra time worked between 12 o'clock noon on Saturday and starting time on Monday morning to be paid for at the rate of double time—this to include recognized holidays.

A Special Sub-Committee was appointed to consider the whole question and report; a decision being arrived at on Monday at a meeting presided over by Alderman Garsden. The Sub-Committee decided not to recommend any increase in the rates of wages, and on the question of overtime they recommended that it should be paid for at the rates recognized in the local building trade.

On Tuesday there was a representative gathering of the men employed in the gas and water, highways, electricity, markets, tramways, baths, and other departments, when the following resolution was passed unanimously:

> That this meeting of Corporation workmen, representing all departments, hereby expresses its keen disappointment at the refusal of the Corporation to concede the men's reasonable demands contained in the recent wage claim, is fully satisfied now that all peaceful means of securing same have been exhausted, and hereby urgently calls on the district office to at once tender notice to cease work unless our claims are generally acceded to.

Mr. Arthur Lees, the local representative of the Union, who attended the men's meeting in the absence, through indisposition, of Mr. J. R. Clynes, M.P., the Secretary of the Lancashire district, stated that unless the wage claim was immediately settled every phase of municipal life would be interfered with.

The whole position will be reviewed at a meeting of the General Purposes Committee early this week; and it is on this understanding that the men's notices have been suspended for a week. Between 300 and 400 members of the Gas Workers and General Labourers' Union are employed by the Corporation.

The contention of the Corporation is that the men are paid quite up to the standard rate, and that more cannot be expected. It is also urged that it is unreasonable of the men to demand from the Corporation something which private employers did not concede, and which other Lancashire undertakings did not pay. A member of the Special Sub-Committee states that the workers' deputation were asked if they could mention a single case where the Corporation were paying under the standard rate, and not one instance was forthcoming. On the other hand, it was pointed out that there were several men in the employ of the Corporation who were receiving better remuneration than workers in other towns.

ORIENTAL GAS COMPANY, LIMITED.

Annual Report—Public Lighting Question in Calcutta.

In the report which the Directors of the Oriental Gas Company, Limited, will present to the shareholders at the annual meeting to-morrow they refer to the public light question in Calcutta.

At the annual meeting last year, the proprietors were informed that divergent opinions were entertained by the Board and the Corporation of Calcutta in regard to the true interpretation of some of the clauses in their contract for the public lighting, and that the parties had agreed to refer all matters in difference to arbitration. Since that date the proceedings had been duly initiated, and, after a very full and careful inquiry, and after hearing the parties by their officers and counsel, the Arbitrators delivered their award on the 28th of August. With this award the Directors say they have no reason to be dissatisfied, being of opinion that its findings constitute an ample vindication of the propriety of the action they took in order to have the points at issue between the parties adjudicated and settled once for all. One of the chief of these points was the contention of the Corporation that they were not liable to pay for any gas supplied to them in any part of the city above the minimum pressure which the Company were bound to give in the remotest districts, the maintenance of which necessarily involved much higher pressure in the central parts. The result of this was, in effect, that the Company were being held bound to supply, over a considerable portion of the city's area, gas for which the Corporation contended they were not liable to pay. This vitally important issue was decided in the Company's favour by the Arbitrators, who prescribed a scale of pressures adjusted to the respective positions of the points of supply in relation to the centre of distribution, and ordered that the payments to be made for gas should be calculated upon this scale. The gas-rental for the financial year suffered by the loss of revenue thus incurred prior to this decision of the Arbitrators; but the Directors say it is gratifying to be assured that, under the award, this loss will not recur. The award also directed payment by the Corporation to the Company of a sum of money in satisfaction of their claims, though not fully commensurate with their loss.

The Directors report that the general operations of the Company have been fairly extensive, though less than in the preceding year. They include the laying of 36 miles of mains within the areas of the Calcutta Corporation, the Municipalities of Cossipore-Chitpore and Manicktolla, and the Eastern Bengal State Railway. Of this work, 22 miles were relay, and the balance was new extension rendered necessary to meet increased public lighting. New beds of regenerative retorts were constructed and were charged in February, since which time

they have been working to the complete satisfaction of the General Manager. Further similar beds are in course of construction. The stoking machinery has been duplicated, and other plant has been installed. A new tar-tank has been constructed, and a new store has been erected within the works, which will effect much economy in the handling of material.

Subject to what has been said above in regard to the payments for the Calcutta public lighting, the Directors consider the revenue account satisfactory. The private lighting shows a gratifying increase, and they have resolved to make a further reduction of 8 annas per 1000 cubic feet in the price to private consumers from the 1st of January next. The markets for residual products have been wholly satisfactory. The rate of exchange was favourable over the year's transactions, notwithstanding a slight temporary fall below the par of 16d. The Directors recommend the payment of the usual dividend of 4½ per cent., free of income-tax; making a total dividend of 8 per cent. for the year.

HEREFORD GAS MANAGERSHIP.

Views on Salary.

There was some discussion at the last meeting of the Hereford Town Council upon the report of the Gas Committee, which set forth the regret of the Committee at the resignation of Mr. W. W. Townsend, on his appointment as Engineer and Manager of the Colchester Gas Company, and stated that a successor was being advertised for, at a salary of £250 per annum, with house, &c.

Referring to this matter, Alderman Witts said he did not think that they could get an efficient successor to Mr. Townsend at a commencing salary of less than £250. The output of gas was now 150 million cubic feet a year, as compared with 130 millions when Mr. Townsend came to Hereford. Both Alderman Witts and Mr. Parlby expressed regret at the departure of their Engineer. Mr. Langford agreed in this, but added that he did not see why they should give £250 a year to the new man as a commencing salary. The Committee should not have advertised a figure of £250 without consulting the Council; and he moved as an amendment that the salary be £200. The Mayor remarked that Mr. Townsend had brought the undertaking to a very high level of efficiency; and they wanted a good man who could maintain it. Alderman Witts replied that if they were going to override the considered judgment of the Gas Committee on the question of the salary to be offered, they would be incurring a grave responsibility. If the Committee thought they could save £50 they would do it; but in this case it would be economy to give £250. To offer £200 would be playing with the gas-works.

The amendment was lost by a large majority, and the report was adopted.

DEVELOPMENT OF THE HARWICH GAS SUPPLY.

A New Holder Inaugurated.

The Mayor of Harwich (Mr. E. Saunders, J.P.) last Tuesday turned on gas from a new holder to the district of the Harwich Gas Company. The capacity of the holder is 250,000 cubic feet; * and it has been erected by Messrs. S. Cutler and Sons, who were complimented upon the excellent manner in which they have carried out the work.

After the ceremony (which was witnessed by a large number of invited guests), the party were the guests of the Chairman (Mr. H. J. W. Jervis) and Directors of the Company at luncheon at the Alexandra Hotel. In proposing the toast of "The Mayor," Mr. Jervis, who presided, referred to the development of Harwich. In 1887, he said, the Company sold 12,100,000 cubic feet of gas, while last year they sold 48,000,000 cubic feet. In 1887, the total storage capacity was 10,000 cubic feet; while now, with the new holder, it was 400,000 feet. The developments would not end here. The Company were in the initial stage of the re-organization of the whole works, which they meant to make a model. Mr. J. T. Jolliffe proposed the health of the Contractors, and said he felt quite confident in recommending the Directors to entrust the construction of the new holder to Messrs. Cutler and Sons, as he was sure they would do the work well. The new holder was one of the most perfect examples of engineering work which it was possible for any contractor to turn out. Mr. S. Cutler acknowledged the toast, and proposed the health of the designer of the holder—Mr. Jolliffe. Mr. Cutler then presented the Mayor with a silver salver, and the Chairman with a gold cigarette case, as mementoes of the occasion.

PROFIT-SHARING BY WORKERS.

Mr. George Clarry on the Change in Industrial Life.

A paper entitled "Labour Co-Partnership and Profit-Sharing" was read at Cardiff last Tuesday, before the Local Branch of the Chartered Institute of Secretaries, by Mr. George Clarry (Chairman of the Council), who said that limited liability, coupled with the factory system, had wrought a gigantic change in the industrial life of the country; and the relations between employer and employed were entirely revolutionized. How could they, he asked, restore the feeling of individual responsibility and confidence in a large works owned by a company? Those who had closely studied the problem, stated that it could be done by giving standard wages, *plus* some share in the profitable results of their collective labour. Profit-sharing was regarded as an advance upon the ordinary wage system; but it did not

* A photograph of the holder appears on p. 653.

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go far enough. Co-partnership did not propose to abolish the wages system and the payment of interest on capital, but to modify it by consolidating the interests of labour and capital. Give the worker a share in the capital of the business, and as part-owner he would be expected to take a share in the responsibility; so that, instead of one or two having to carry the burden of responsibility upon their shoulders, each worker must take his proportion. Mr. Clarry quoted opinions as to co-partnership encouraging better working, and said it recognized that the success of industry depended upon labour as much as upon capital, and therefore gave to labour a share in the profits proportionate to its industrial importance. As a shareholder, the workman obtained the ordinary rights of a shareholder; but co-partnership did not involve handing over the control of any business to the wage-earner, for this would be to sacrifice the training and experience of the highly-skilled managers of industry. Whatever might be the future of the great labour question, the part taken by the advocates of co-partnership would be acknowledged as an honest endeavour to promote peace and prosperity, not only among the workers, but among the entire trading community.

GALVANIZED IRON FOR WATER-PIPES.

A Possible Danger to Health.

Further correspondence on this subject appeared in a recent number of the "Sanitary Record and Municipal Engineering." "A Civil Engineer" points out that attention was called, in the "JOURNAL" for Jan. 14 last, to the possible danger to health by the use of galvanized iron water-pipes; and he says he learns unofficially that, as the result of the prominence given to the matter by our contemporary, the Institution of Water Engineers would like to take it up. He suggests that engineers and chemists who are able to contribute their views will be performing a public service if they do so. Another correspondent, an associate member of the Institution of Civil Engineers, says the question as to whether or not galvanized pipe should be employed depends upon the local conditions of the district. If the strata consist of gravel and brick earth, it is most inadvisable to use this class of material, owing to the large amount of iron and manganese in the ground. This attacks the pipes, eats its way into them, and they soon become rotten. If the geological formation is composed of stone or boulder clay, which is generally found overlying the coal measures, the writer's experience has been that galvanized steam-pipes are quite as good as lead piping. He does not think a definite line can be taken as to whether galvanized or lead pipes should be universally used, as every district must be considered on its merits. He has a case filled with at least a hundred different specimens of galvanized pipes which have been taken out of ground composed of gravel and brick earth, and he says it is a very remarkable fact that, owing to their decayed condition, any water ever reached the consumers.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

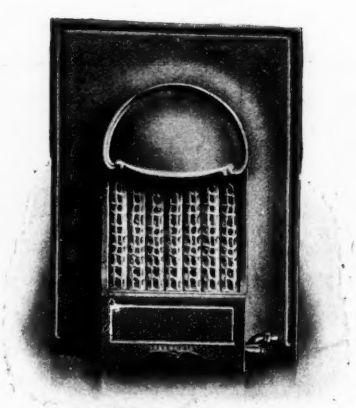
The storage capacity of the Newmilns Gas-Works has been increased by the erection of a holder capable of containing 95,000 cubic feet of gas; and a visit of inspection was recently paid to the works by Provost Pollock, Bailie Steel, and Councillors Lang and Mair. The gasholder was supplied by Messrs. Newton, Chambers, and Co., Limited, and its erection superintended by Mr. Fairweather, who gave lucid explanations concerning the work which had been done to bring the plant up to date. He pointed out that the addition of another 20-feet lift would be a very simple matter. After the inspection, the party dined together—Mr. Fairweather in the chair.

An interesting lecture on "What should we Do without Gas?" was given by Mr. Walter Grafton, of the Glasgow Gas Department, on Monday last to the Ruchell Brotherhood, Maryhill. The lecture was illustrated by lantern slides, and was amplified by experiments depicting the old and new methods of lighting and heating the home, and the many other purposes to which gas can be applied with great advantage to the user. It was shown to have a place in the service of man for every hour of the day and night.

An Association has been formed in Glasgow within the last two months which is composed of all the foremen in the gas industry of Glasgow, both in the manufacturing and distributing departments, and it is known as the Foremen's Association of the Corporation Gas Department. One of its principal objects has been to make it a protective force to combat the existing method of filling vacancies that occasionally occur. Promotion in this department is said to be very slow; and the foremen feel, where they have over one hundred foremen supervising work, that among such an army of hard-headed Scotsmen sufficient intelligence, tact, and energy might be found to warrant promotion from their ranks when opportunity arrives. While they find no fault with their brethren over the Border, they claim that, other things being equal, home talent has first claim, as knowledge of local conditions should add weight to any application for such appointments. While the foregoing may be the primary reasons for banding themselves together, they have the further objects of helping and stimulating each other and promoting the interests of the department and the honour of their city. Their future policy has not yet been mapped out, but they intend opening discussions on meeting nights, and visiting other gas departments or industries where gas is used, so that they may be mutually helped in their work, and fitted to rank as being in the forefront of the industry.

The discussion and visits would, it appears, be likely to clash with those of the Western District Section Junior Gas Association, and the discussions might well be allowed to take place at the meetings of the Junior Association in the Technical College. Foremen in the Gas Department, if they do not already belong to this Association, would

"MAIN" MEANS MINIMUM MAINTENANCE.



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probably be welcomed as members, when they would be able to take part in the discussions; and doubtless Mr. Fulton, the Secretary, would be only too pleased to receive papers which would initiate talks upon subjects which would be of special interest to the foremen. There is no doubt, however, that this portion of the programme of the Foremen's Association is only a side issue, and that the principal object is the binding of themselves together to form a species of foremen's trades union, so as to try to prevent the appointment of outsiders to those positions which the foremen consider they should be asked to fill. That appointments such as these should be made from the ranks of those already serving the Corporation, there is no doubt, provided always that the foremen are keeping themselves abreast of the times, and thereby fitting themselves for the higher positions. Many, however, think that, when they have become foremen, their work in the matter of learning is finished. The man, however, who wishes to go forward must remember that he must continue learning till the end of his days. The Association held their first annual dinner in the Trades House Restaurant, when Mr. J. L. Scott, the President, occupied the chair, and the foremen had the support of Councillors P. G. Stewart, Hugh Alexander, and A. R. Turner, Mr. D. S. Dobbie, and Mr. R. Liggett, the Secretary. Councillor Turner proposed the toast of "The Foremen's Association," and congratulated the members on the stand they were making in the interest of justice and equity, and said that their having banded themselves together would help not only themselves but the Corporation also.

Several Provisional Orders are being applied for which are of interest more or less to those who supply gas. The Lanarkshire County Council have given notice of their intention to apply to the Secretary for Scotland for a Provisional Order to give them powers to enable a District Committee of the county to supply gas for heating, cooking, and motive power, and for any purpose to which gas can be applied, and to provide, sell, let, hire, or deal in fittings and apparatus for any of these purposes. Glasgow has an omnibus Order which deals with the lighting of private streets, courts, and common stairs. It provides that proprietors shall equip common stairs with gas or electric lighting, and that the Corporation shall undertake the lighting of private streets, courts, and common stairs, and levy an assessment therefor—equally on proprietors and occupiers. The Edinburgh Corporation are applying for extensions of the boundaries in their Electric Lighting Order of 1891, so as to include Crammond, Corstorphine, Colinton, Liberton, and Newton, all of which are in the county of Midlothian. There appears to be some possibility of opposition to this Order, owing to the power of the Colinton Tramway Company to apply to the Board of Trade for a Lighting Order in that district. The Company have already power to erect a generating station at Redford, and to light the new cavalry barracks there; and the Edinburgh Corporation have offered to supply the Company with current at the boundary of their supply in bulk, at the same price as they would sell it at to a firm in the heart of the city. Kilmarnock has also given notice to the Board of Trade, that the Provost, Magistrates, and Councillors desire power to extend their limits of supply to include the municipal burghs of Irvine, Troon, Galston, Newmilns, and Darvel, the parishes of Kilmarnock and Riccarton, portions of the united parishes of Monkton and Prestwick, and portions of the parishes of Dundonald, Symington, Craigie, Galston, Sorn, Loudoun, Fenwick, Kilmaurs, Dreghorn, and Irvine—all in the county of Ayr. It is kind of the Town Council to state that these places are all in the county of Ayr, or one might suppose that they wished to include Great Britain in their new district. The powers sought under this Order are certainly more than those usually desired by town councils, and it will require considerable examination by the authorities before the precedent is established that a large corporation should be granted leave to supply a commodity so far away from their own boundaries, and in the territory of other governing bodies. However, these bodies will no doubt be able to look after their own interests, and in some cases they have already approached the Kilmarnock Town Council; so that they evidently are not averse to this Order.

A meeting of a section of the Kirkcaldy branch of the Gas Workers and General Labourers' Union was held at Kirkcaldy for the purpose of taking a ballot on the question of the establishment of a political fund under the Trades Unions Act of 1913. The vote resulted in a majority in favour of political action. Another vote of the members of the Eastern District will take place on Monday next.

A special meeting of the Town Council of Buckhaven, Methil, and Innerleven was held on Monday to confirm the resolution of May 17, that the burgh adopt the Burghs Gas Supply (Scotland) Act. Bailie Taylor, the Convener of the Gas Committee, proposed the motion, and said that the burgh required a revenue-producing scheme. He was convinced, from what he had seen of the working of gas schemes in towns where they owned the supply, that this was a good source. Mr. Smart seconded, and the motion was adopted. It is interesting to find the Council unanimous in favour of this municipalizing of the gas supply, as there have been great dissensions in regard to many matters since the new Council were elected.

The Falkirk Town Council have reappointed the Committee who were elected to go into the question of the underpinning of the retort-bench, though many thought that this matter had now been completed. However, the feeling was that there was still much to be done, first, in seeing that the measures taken have been efficacious, and also to fix the remuneration to be given to Mr. M'Kee for his services in the matter. This last was a point very much discussed at the meetings held before the recent elections.

The Late Mr. Daniel Macfie.

We learn that arrangements have been made for the continuation of the business carried on by the late Mr. Daniel Macfie at North Saint Andrew Street, Edinburgh. It will be conducted as formerly under the name of "Daniel Macfie," and will be for behoof of Mrs. Macfie. The services of Mr. Allan Young, who was Mr. Macfie's valued assistant for several years past, have been retained, and he will act as representative.

The "FLAMBEAU."

Artistic Perception

A great change has been taking place in the artistic perception of the Public—an extraordinary improvement has manifested itself in every section of the applied arts. Architecture, Furniture, Wall Papers, Fabrics, Panelling, Ornaments have all been vastly improved. Artists have been busily engaged reproducing and adapting to modern requirements the best designs from those periods when arts and crafts were at their best. The trend to-day is all for good design and utility.

THE RICHMOND GAS STOVE

Gasfire

WARRINGTON

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Nov.* 22.

Although there has been a fair demand during the past week for covering previous contracts for November shipment, the volume of actually new business has not been large. Supplies have been ample for all present requirements, and consequently values have barely been maintained. The closing quotations are £12 18s. 9d. per ton f.o.b. Hull, £13 per ton f.o.b. Liverpool, and £13 1s. 3d. per ton f.o.b. Leith. For future delivery the majority of producers still hold very conservative views and continue to quote £13 7s. 6d. to £13 10s. per ton at the ports for January-June in equal monthly quantities. It is reported, however, that there are several middlemen willing to book orders over this period at 5s. per ton less money.

Nitrate of Soda.

The tone of this market is distinctly easier on spot, and values have declined to 10s. 4½d. per cwt. for ordinary quality and to 10s. 7½d. for refined.

Tar Products. LONDON, *Nov.* 24.

There is not very much improvement in the markets for tar products, and, on the whole, business has again been very quiet. In pitch, there has been a further slight reduction, which has permitted some contracts to have been made during the last few days. It would appear that distillers on the whole have now recognized that the fall is genuine; and in many cases they have offered considerable quantities and accepted prices at the equivalent of to-day's quotations. Benzol, 90 per cent., maintains its figure, and shows no signs of weakening. For the forward position, manufacturers are firm in their idea of value, and will not reduce their price at the moment. Solvent and heavy naphthas remain quiet, and contracts are difficult to arrange. Crude carbolic is practically a dead-letter. Creosote is very firm, and the inquiries are most regular. It would appear that any lowering in the value of this article will not be seen for some time.

The average values during the week were: Tar, 27s. 9d. to 31s. 9d. Pitch, London, 40s. 6d. to 41s. 6d.; east coast, 40s. to 40s. 6d.; west coast, Manchester, 40s. to 40s. 6d.; Liverpool, 40s. 6d. to 41s.; Clyde, 41s. 6d to. 42s. **Benzol, 90 per cent., naked, London,** 1s. 1d. to 1s. 1½d.; North, 11½d. to 1s.; **50-90 per cent., naked, London,** 1s.; North, 11d. **Toluol, naked, London,** 10½d. to 11d.; North, 10⅜d. to 11d. **Crude naphtha, in bulk, London,** 5¼d. to 5½d.; North, 5d. to 5¼d. **Solvent naphtha, naked, London,** 10¼d. to 10⅜d.; North, 9¼d. to 9⅜d. f.o.b. **Heavy naphtha, naked, London,** 10d. to 10⅛d. f.o.b.; North, 9d. to 9⅛d. f.o.b. **Creosote, in bulk, London,** 3⅜d. to 3½d.; North, 3d. to 3⅛d. **Heavy oils, in bulk, London,** 3⅜d. to 3⅛d. **Carbolic acid, casks included, 60 per cent., prompt, east and west coasts,** 1s. 0½d. to 1s. 1d. **Naphthalene,** £4 10s. to £10; **salts,** 55s. to 60s., **bags included. Anthracene, "A" quality,** 1½d. to 1¾d. per unit; "B" quality, nominally ¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has again been experienced a quiet week in the market for this article; and the increased demand which was expected towards the end of the month has not materialized. Outside London makes are still quoted at £12; Hull, £12 18s. 9d. to £13; Liverpool, £13; Leith, £13 1s. 3d. to £13 2s. 6d.; Middlesbrough, £13.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a steady demand for coals for prompt delivery, and the shipments have been heavy; but for forward delivery, some buyers are holding-off for lower prices. In the steam coal trade, the demand is rather easier, and there is less likelihood of labour troubles. Best Northumbrian steams are about 14s. 8d. per ton f o.b.; second-class steams are 13s. 6d. per ton; and steam smalls from 6s. 6d. to 8s. 6d. per ton f.o.b. for early delivery; but forward prices are a little less. The gas coal trade is now at the period of fullest delivery, and the production is readily taken up. The quotation for best Durhams is 15s. 6d. per ton f.o.b.; and for second-class gas coal, from 13s. 4d. to 14s. 6d. per ton is quoted. For "Wear specials," 15s. 6d. to 15s. 9d. per ton f.o.b. is the current price at present. Of course, much of the output of coal is taken up by the long contracts at rather lower figures. The prices for prompt delivery are very similar to those of a year ago; but for forward sales, lower quotations are made for all classes of gas coals. One reason for this is said to be the competition at some of the ports in the south of Europe with American coals offered there. Coke is firm. Gas coke is more abundant, and may be quoted from 16s. 6d. to 17s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Throughout the whole of the districts the coal trade in Scotland continues in a healthy condition, and the demand in all departments is strong. On Friday, on the Glasgow Coal Exchange, the following were the approximate figures quoted: Ell, best brands, 13s. 3d. to 13s. 6d.; splint, 13s. 3d. to 16s. 6d.; Navigations, 15s. to 17s.; steams, 13s. to 14s. 6d.; Hartleys, 16s.; trebles, 13s. 3d. to 13s. 6d.; doubles, 12s. to 12s. 6d.; singles, 10s. 6d. to 11s.; pearls, 9s. to 9s. 3d.; dross, 8s.—f.o.b. Glasgow.

Belfast Gas Finance.—The annual report of the Belfast City Accountant to the Finance Committee of the Corporation, which has just been issued, shows, under head of "Revenue received," £21,385 profits from the municipal gas undertaking for the year ended March 31 last; while under the head of "Loan charges" the undertaking is responsible for an amount of £417,075.

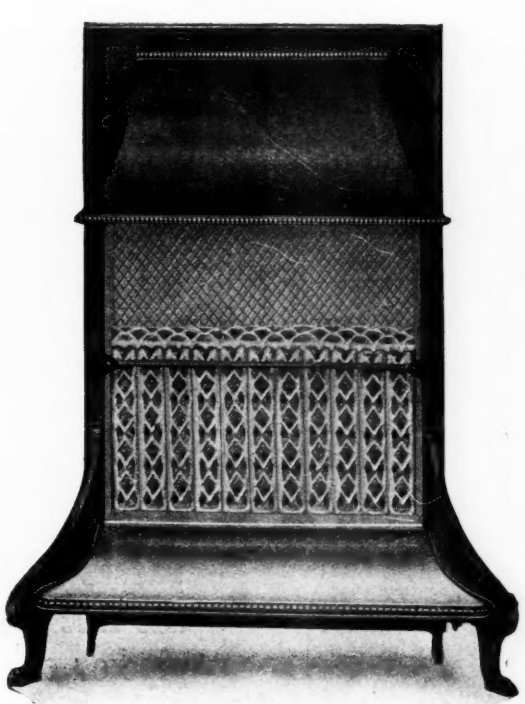
of the Public.

We have recognized that this position has made it necessary to provide Gas-fires suitable for these altered conditions, and in our "PERIOD" Series you can find designs suitable for the most exacting taste. The measurements have been carefully considered to meet the standard size of coal-fire grate, and the appearance is always satisfactory.
A display of "PERIOD" Gasfires in any showroom will convince the most fastidious that Art *can* combine with utility in the modern Gasfire.

AND METER CO., LTD.,

Specialists.

and LONDON.



The "LOUIS."

James Keith and Blackman Co., Limited v. The Tilley High-Pressure Gas Syndicate, Ltd.

We learn that the defendants in the above case have now withdrawn their notice of appeal, so the judgment as given by Mr. Justice Astbury on July 21 holds good. A report of the proceedings and of the judgment appeared in the "JOURNAL" for July 22 last.

Reduction in Price at Brighton.

The announcement is made by the Brighton and Hove Gas Company that after the December quarter meter readings the price of gas furnished to ordinary consumers within the limits of the Company's supply will, until further notice, be reduced by 1d. per 1000 cubic feet; making the charge 2s. 9d. It is stated that this concession represents a saving to the gas-consuming public of £6000 per annum. Commenting on the matter, the "Sussex Daily News" says that the liberal policy followed by the Company may be expected to meet with general appreciation at a time when other items of household and business expenditure show a tendency to rise, and that every reduction in the price of gas may be regarded as contributing to improved social conditions. Each half year the official statistics record remarkable increases in the demand for household conveniences which cannot fail to be still further popularized by the reduction in price now announced.

Gas and Water Charges at Great Harwood.

At the monthly meeting of the Great Harwood District Council last week, Mr. Slater, on the minutes of the General Purposes Committee, referred to the increased charge for water. He said they were given to understand that the water was not a paying concern on the old scale. Gas must, however, have been paying; and now that water was paying, he thought the Gas and Water Board might be able to reduce the charges for gas. The Chairman (Mr. Noble, J.P.) said since the Board took over the concern about thirteen years ago they had lost £50,000 on water alone. This year, however, they were expecting to make a satisfactory profit. With regard to the charges for gas, he intimated at one meeting that he was going to propose a reduction; but a deputation waited upon him, asking him not to press it, as they could not see their way to reduce the gas charges. In the first place, the Board wanted to get a standing balance on which they could fall back. He thought water should pay for itself, and not have to be assisted out of the gas profits.

At a recent sale by auction, 800 £5 "C" ordinary shares in the Littlehampton Gas Company realized £4404—an average of a little more than £5 10s. each.

Gas v. Electric Light at Southend.

A proposal to place thirteen electric lamps on the Southchurch Road led to some candid remarks at last Tuesday's meeting of the Southend Town Council. Mr. Newitt inquired whether the Highways and Works Committee had considered the desirability of using high-pressure gas instead of the electric light, and whether Mr. Smith (the Acting Chairman of the Committee) was aware that the difference in the price of electric light and high-pressure gas was very great. Mr. Smith replied that he did not know that there was much difference in the price. He thought the Council's idea generally was to favour their own undertaking. There had been some nasty remarks about favouring the Gas Company. Wherever a cable was laid, the Highways Committee always considered the advisability of installing electric light instead of gas; and this was what they had done in the present case. On this, Mr. Newitt returned to the charge, with the assertion that electric lamps bore no comparison, to his mind, with high-pressure gas. Electric light was always flickering, intermittent, and expensive; and it seemed to him that the only reason they had electric lamps in the borough was to add to the profit of the electricity undertaking, when it was not really a profit. If they had high-pressure gas, he was certain they could save £20 a year on each light. Exception to these "wild statements," as he termed them, was taken by Mr. Cooney; and Alderman Martin echoed this. A proposal to refer the matter back was defeated by a large majority; and the proposal of the Committee was then agreed to.

Filtration of Newry Water.—The Newry Urban District Council have discussed at considerable length the question of the alleged pollution of the water supply from Camlough Lake, to which reference was made last week (p. 618), and they have instructed the Engineer (Mr. Blaney) to proceed with the necessary survey and preparation of plans for the construction of filter-beds and the enlargement of the reservoir to about double its present capacity. A consulting engineer is to be called in.

Compensation for Damage to Wandsworth Bridge.—In the "JOURNAL" for the 13th of May last, we reported the proceedings in an action brought by the London County Council against the Wandsworth and Putney Gas Company for damage done to Wandsworth Bridge on June 12, 1912, by the alleged negligent navigation of the steamer *Wandle* by the Company's servants. The case was tried by Mr. Justice A. T. Lawrence and a Special Jury, and it resulted in a verdict for the plaintiffs—the question of damages, if not agreed between the parties, to be submitted to a referee. The Council recently announced that they had accepted the offer of the Company of £4100 in settlement of their claim. The Council now report that their costs were taxed, and allowed at £833 3s. 8d.; and that this amount, together with £16 15s. 11d., being the interest thereon from the date of the judgment, has been received from the Company

IT is a Fact that Gas Fire Burners constructed on present-day lines do not cause smell. But unless a fire is made on strictly Hygienic Principles products of combustion may enter the room and contaminate the air. Your Enterprise might, therefore, be wasted in booming Gas Fires if they are not Hygienically Perfect! Do not treat this statement too lightly, but remember
We definitely GUARANTEE that every Fire we send out passes all its products through the flue outlet, unaided by flue pipe or chimney draught.
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New Issues of Gas and Water Capital.

The sale conducted by Messrs. A. & W. Richards at the Mart, Tokenhouse Yard, last Tuesday was of an unusual character; only new issues of capital being submitted by order of Directors. The Aldershot Gas, Water, and District Lighting Company offered £8500 of "C" consolidated stock, and £500 of 4 per cent. consolidated preference stock. The first-named stock ranks for a maximum dividend of 5 per cent., which is now being paid on similar stock; and it was all sold at £90 to £91 per £100. The consolidated preference stock fetched £82 per £100. The next lots consisted of an issue of 500 ordinary £10 shares in the Bognor Water Company, carrying 7 per cent. dividend; and they were all sold at £14 2s. 6d. to £14 7s. 6d. each. The final lots were £5 "B" shares and some second perpetual 5 per cent. debentures of £100 each of the Pinner Gas Company, Limited. The shares rank for a standard dividend of 7 per cent., subject to the sliding-scale; but the dividend for the year ended the 30th of June last was at the rate of £9 12s. 6d. per cent. They were all sold at £9 5s. each; and the debentures fetched £105 apiece.

Leeds and the Doncaster Water Supply.—The Doncaster Corporation have given their final assent to an agreement with the Leeds Corporation for an additional supply of water, to which reference has already been made in the "JOURNAL." The Corporation of Leeds have undertaken to supply, and Doncaster to take, 500,000 gallons of water per day, at the rate of 8d. per 1000 gallons, with the option of increasing the demand until it reaches 4 million gallons per day at the same rate. On the minimum basis of supply, the Corporation will have to pay Leeds £6000 per annum. It is estimated that Doncaster is assured an adequate supply of water for the next fifty years.

Portsmouth Water Company.—At the half-yearly meeting of the Company last Thursday, the Directors reported that the balance available for distribution was £24,891, and out of it they recommended the payment of the full statutory dividends. This, after deductions for void houses, &c., left a balance of £4514 to be carried forward. The quantity of water supplied during the six months ended Sept. 30, was 1,589,587,122 gallons, equal to an average daily supply of 8,686,269 gallons; being an increase of 120,641 gallons compared with the corresponding period of last year. The quantity supplied for domestic use averaged 23·18 gallons per head per day, or 0·65 gallon less than before. Reference was made to the resignation of the clerkship of the Company by Mr. J. L. Wilkinson, and to the appointment of Mr. R. Bishop as his successor; also to the appointment of Mr. H. Ashley as General Manager—changes which have already been notified in the "JOURNAL." In moving the adoption of the report, the Chairman (Colonel C. L. Owen) said that, though the half year had been uneventful, the increase in the meter-rentals had been £1268 over 1911, which up to then was the highest year on record. The report was unanimously adopted, and thanks were accorded to the Directors and staff.

Additional Filter-Beds for London.—At the last meeting of the Metropolitan Water Board, the Works and Stores Committee recommended: (*a*) That the estimate of £150,000, to be submitted by the Finance Committee, be approved, and that the appropriate standing Committees of the Board be authorized to incur expenditure covered by this estimate in the construction of 15 acres of filter-beds at Kempton, sanctioned by the Board's Act of the past session, and the acquisition of the necessary land; and (*b*) that the Works and Stores Committee be instructed to obtain and submit to the Board tenders for the construction of these beds. This was agreed to.

Water from Colliery Workings for Oldham.—In the "JOURNAL" for April 9, 1912 (p. 122), we gave some particulars of the scheme which had then just been completed for the supply of water to Oldham from the disused workings at the Butterworth Hale Colliery of Messrs. Platt Bros., Limited. The quantity available was originally estimated at 750,000 gallons per day; but we learn that it has been only 69,000 gallons. It appears that there has not been any water for some days; and it is reported that there will be none for many weeks. The Oldham Corporation obtained in 1909 parliamentary powers to utilize this source of supply; and the incidental works have up to the present time cost about £25,000.

Loans for Main Laying at Devonport.—It was reported at the last meeting of the Devonport Town Council that the Local Government Board had expressed its willingness to sanction the borrowing of money for the general purpose of laying new gas-mains without specifying any particular street or district (the amount of the application being a sum sufficient to cover the estimated expenditure during three years), on the understanding that a detailed statement of the expenditure and plans showing the mains laid are subsequently furnished to the Board. On the recommendation of the Gas Committee, it was decided to ask the Board to cancel the existing sanctions for gas-mains so far as the borrowing powers remain unexercised, and to authorize the borrowing of £3500 which it is estimated will be required during the next three years.

Burgess Hill Water Company.—The half-yearly general meeting of this Company was held last Thursday—Major S. T. Maynard in the chair. In their report, the Directors recommended the declaration of a dividend of 3¾ per cent. on the original and 2⅝ per cent. on the new ordinary shares, free of income-tax; being at the same rate as for the six months ended Sept. 29, 1912. In moving the adoption of the report, the Chairman said the Company had now completed their outlay with regard to additional works in the direction of increasing the supply of water; and he hoped the capital account might now be closed for some time to expenditure of this kind. He thought the shareholders would appreciate that this expenditure, though it had been a serious load to carry, was very essential, and that it was most desirable the Company's supply of water should be reasonably ahead of probable requirements of consumers in the district for some years to come. The report was adopted.

The FINGER-POST of PROGRESS.

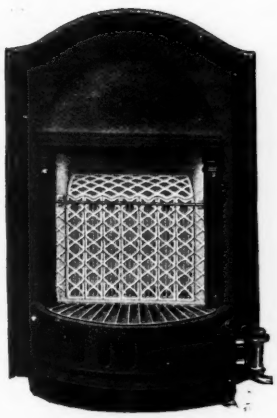
1904:
WILSON "CIRCULATOR" WATER HEATER.

EARL'S COURT EXHIBITION 1904.

MEMORABLE for the introduction of the **WILSON "CIRCULATOR."** —The First of its Kind.

SHEPHERD'S BUSH EXHIBITION 1913.

MEMORABLE for the introduction of the **WILSON "SOLA" GAS FIRE** —The Foremost of its Kind.



1913:
WILSON "SOLA" GAS FIRE.

THE PIONEERS: WILSONS & MATHIESONS, Limited,
Carlton Works, ARMLEY, LEEDS.
LONDON SHOWROOMS: 76, QUEEN STREET, CHEAPSIDE, E.C.

Derwent Water Board Outlay.—A revival of the controversy between the Sheffield Corporation and the other authorities constituting the Derwent Valley Water Board is threatened in a very acute form; the former having now given notice of their intention to promote a Bill under which powers are sought to set aside the recent award by which they were held to be responsible for a proportionate contribution to the whole of the works, instead of for a portion only of the cost of the main aqueduct as far as it was constructed to the point necessary for their supply. Opposition to the measure will be forthcoming from the Nottingham, Derby, and Leicester Councils.

Limavady Gas-Works Leased.—A special meeting of the Limavady Urban District Council last Friday passed unanimously a resolution accepting the proposal of Messrs. Anderson Bros. that the Council should grant them a lease of the Limavady Gas-Works, on terms and conditions set forth in the draft lease prepared and submitted by the Council's Solicitor, and that the sanction of the Local Government Board for Ireland to the completion of the lease be obtained. Mr. Donaghy said the Lighting Committee were deserving of congratulation on the successful manner in which the negotiations had been conducted; and he mentioned that the leasing of the gas-works would be equivalent to a rent of £100 annually accruing to the Council.

Holywell's Two Water-Works Schemes.—At the last meeting of the Holywell (Flintshire) Urban District Council, Mr. T. Waterhouse, the Chairman of the Finance Committee, submitted, in accordance with a request, figures as the relative cost of obtaining a water supply for the town from the Birkenhead Corporation's main at Clawdd Newydd, near Derwen, and from St. Winefride's Well; the Council having already adopted the latter scheme pending a Local Government Board inquiry. He put the estimated cost of the Birkenhead scheme at £13,871, that of the well scheme at £6345 Mr. J. Philip Jones criticized the figures, and contended that the Birkenhead aqueduct could be tapped 7½ miles from the town, and that it was unnecessary to go 17½ miles for the purpose. He said the Birkenhead water was far superior to that of the well. It was eventually decided to receive a report from Mr. Jones.

Electric Light Safeguards.—At Birmingham last Friday, Messrs. William Bayliss, Limited, tube manufacturers, were summoned, under the Factories and Workshops Act, for neglecting efficiently to earth metalwork and a portable lamp, in consequence of which neglect a workman named George Farraday suffered bodily injury. They were also summoned for neglecting to provide efficient means, suitably located, capable of cutting-off and controlling electrical pressure. Mr. J. E. Harston, an Inspector of Factories, stated that in consequence of the defendants' neglect Farraday received a severe electric shock and was admitted to the General Hospital. On behalf of the firm, it was stated that electrical experts had seen the apparatus only fourteen days before the accident, and it was tested by them. Dr. Sampson said he had never seen such a severe case of electric shock. Defendants were fined £50 and costs in the first case, and £5 and costs in the second.

Lighting of Parliament Square.—The last issue of the "Sanitary Record" contained the following paragraph on the way in which the public lighting in the vicinity of the Houses of Parliament is carried out by the Office of Works: "Just examine the public street-lamps maintained by the Office of Works around the Houses of Parliament, Trafalgar Square, &c., and it will be found that the lamps and burners are of the archaic pattern which did duty twenty to thirty years ago, and compare them with the lamps of the Westminster City Council in adjacent roads. The Office of Works' lamps give, through ignorance in management, not more than one-third of the effective illumination which should be produced. The oldest, and elsewhere discarded, pattern of Welsbach burner is used, with the result that the mantles are never properly incandescent, while the lanterns are unprovided with reflectors, to shed the light on to the street below."

Ilfracombe Gas Company.—The fiftieth annual meeting of this Company was held last Tuesday—Mr. C. H. Darbyshire presiding. The Directors' report showed that the receipts had been £13,572; and after deducting £10,602 for the cost of supply and all charges, there remained a profit of £2970. To this amount had to be added £948 brought from last year. After paying twelve months' interest on the debentures, there was left for disposal a balance of £3202, out of which the Directors recommended the payment of a dividend of 4½ per cent., less income-tax, the placing of £200 to the reserve fund, £462 to the depreciation fund, and the balance, after providing for Directors' and Auditors' fees, to be carried forward. The Chairman, in moving the adoption of the report, said that, comparing the gross receipts with those of the previous year, there was an increase of £1504; while the expenses showed an advance of £418. He was glad they were able to establish a reserve fund, which the shareholders had wished for several years. The report was adopted.

A Manchester Gas Employee's Death.—A verdict of "Death from natural causes" was returned last week by a Manchester Coroner's Jury after listening to evidence concerning the death of John Owen (48), who had been employed for more than twenty years as a stoker at the Bradford Road Gas-Works, and who died at his home on the 13th inst., under circumstances which suggested that the primary cause of death was due to the man having been "gassed" while following his employment. The widow stated that the deceased was overcome by gas fumes upwards of three years ago, and had not been able to work since. For the first three months after the accident, compensation at the rate of 10s. per week was regularly paid. In reply to Mr. A. F. Pickford, who attended on behalf of the Corporation Gas Department, the widow stated that she did not know that the money referred to was paid by way of gratuity; as a matter of fact, she did not know the difference between the two words. She insisted, however, that the payment was looked upon as compensation. Dr. Bosdin Leech, of Manchester, who made a *post-mortem* examination, expressed the opinion that death was due to pneumonia coupled with advanced degeneration of the valves of the heart; and the Jury therefore returned a verdict in accordance with the medical evidence.

The "Positive"

"THE METER OF MANY MERITS."

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MILES PLATTING, MANCHESTER.

BRANCH OF METERS LTD. RADFORD ROAD, NOTTINGHAM.

Agents for Scotland: JNO. D. GIBSON, 2, CAUSEYSIDE STREET, PAISLEY.

Debenture-Holders' Action.—Mr. Justice Sargant heard yesterday an action *re Alfred Williams and Co., Limited, South Metropolitan Gas Company v. Alfred Williams and Co.* Sir D. Warmington said the case came before the Court as a "short cause" upon motion for judgment in default of appearance on the part of the defendants. There was nothing particular in the case; and he asked for the usual judgment in a debenture-holders' action. A Receiver had been appointed, but the amount collected by him would not be sufficient to meet that due on the debentures, and there was no chance of any further sums being got in. An order for the sale of the property had been made. His Lordship made the usual order.

Quality of Cork Water.—A meeting of the Water Committee of the Cork Corporation recently received a report from the City Engineer (Mr. Delaney) in regard to discussions at the Public Health Committee on the quality of the water supplied to the city. He stated that a conference took place at the pumping-station between the Medical Officer of Health, the City Analyst, the Resident Engineer, and himself; and that, as a result, it was deemed advisable to procure analyses of the filter-tunnel water and the supplies from the pure-water basin, the two reservoirs, the water-tower, and the Mile End stream, and to have the tunnel cleaned. The Resident Engineer said all the water supplied to the citizens was taken from the tunnel. Mr. Delaney said a further report would be submitted in due course.

Plymouth Water-Works.—Mr. F. Howarth, Water Engineer to the Plymouth Corporation, presented his annual report to the Water Committee last Friday. The income from supplies of water for the year ended March 31 last was £33,048—a decrease of £531 as compared with the previous twelve months. This reduction was explained by the fact that the summer of 1912 was wet, while in the previous year there was an abnormal increase of revenue owing to the hot weather. The gross profit, amounting to £23,437, was £806 less than in 1911-12. After deducting £16,035 for interest and sinking fund, there was a net profit of £7402 The average daily consumption of water was 43·21 gallons per head; but though this rate is high, the waste, as ascertained by the flow between midnight and 4 a.m, has been considerably reduced within recent years.

Newtownards Water and Sewerage Schemes.—Mr. P. C. Cowan, the Chief Engineering Inspector of the Irish Local Government Board, held an inquiry last Wednesday into an application by the Newtownards Urban District Council for sanction to supplementary loans amounting to £3000 for the completion of the water-works and sewerage schemes. The Town Clerk (Mr. M'Cartney) said that there had recently been a shortage of water owing to the dry season; but he assured the Inspector that both the water and sewerage schemes had been of great benefit to the community. It was stated that the tunnel in connection with the water supply would be completed immediately. There was more water than had been anticipated; and it was confidently expected that in normal years there would be a sufficient supply. During the dry season, the weekly average was 56,477 gallons per day; but at present it was upwards of 170,000 gallons.

New Offices for the Penzance Gas Company.—In order to meet the growing demands of their business and provide for the proper display of stoves and fittings, the Penzance Gas Company have opened new offices and show-rooms. A portion of the premises was used by the Company as offices, and addition has been made by taking in an adjoining building and remodelling and reconstructing it. The building has a spacious window for the display of goods. A feature of that portion of the offices used by the public is a number of recesses in the dado for the installation of new designs in stoves. On the floor above is a spacious show-room. The building is a striking and attractive feature of the architecture of the town.

St. Helens Gas Undertaking.—On the 21st inst., Mr. Meade King held an inquiry into the application of the St. Helens Gas Committee for sanction to a loan for the new offices and also for mains and services. Mr. Andrew (the Town Clerk) stated that during the past year £1480 had been expended on new mains and services, and it was estimated that £6750 would be needed for the next three years. They therefore applied for a total of £8230. The second application was for £3550, which had been expended in building offices, show-rooms, and a large room for the Committee meetings. In reply to the Inspector, it was stated that the cost had been paid by loan from the bank. There was no opposition to either application.

APPLICATIONS FOR LETTERS PATENT.

25,815.—Bland Light Syndicate, Ltd., and Gould, F. J., "Gas-burners." Nov. 11.
25,817.—Gabbett-Fairfax, H. W., "Air and gas compressors." Nov. 11.
25,853.—Hibberd, C. E., and Goad, F. L., "Gas-meters." Nov. 11.
25,900.—Capper, J. R., and Williams, A. H., "Gas-furnaces." Nov. 12.
25,918.—Hunter, C. M., "Gas-governors." Nov. 12.
25,923.—Morris, J. T., "Measuring the velocity of flow of gases." Nov. 12.
25,934.—Armstrong, J., "Gas-stoves." Nov. 12.
25,970.—Scott-Snell, E., "Carburetting and compressing air for lighting and heating." Nov. 12.
25,995.—Priest, C. F., "Gas firing producers." Nov. 13.
26,055.—Glover, G., and Co., Ltd., and Douglas, W., "Coin-freed meter mechanism." Nov. 13.
26,057.—Southey, A. W., "Production of gaseous fuel." Nov. 13.
26,134.—Gould, F. J., "Inverted fittings." Nov. 14.
26,157.—Brown, D. A., "Acetylene generators." Nov. 14.
26,184.—Ironside, E. A., "Conveyors for coal." Nov. 15.
26,255.—M'Court, C. D., and Bonecourt Surface Combustion, Ltd., "Generation of steam." Nov. 15.
26,257.—Pew, A. E. H., and French, T. E., "Blower or meter." Nov. 15.

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is to increase the output of Gas in every possible way. The Gas Fire offers unlimited scope now that the general public are beginning to realise its great value—but the fire must be scientifically and practically constructed, replete with all modern improvements, and at a popular price—in other words

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Oswaldtwistle Price for Power Reduced.—At a meeting of the Oswaldtwistle Urban District Council on Thursday, the question of the price of gas to large consumers was discussed; and it was resolved that, where the consumption for power purposes exceeds 80,000 cubic feet per month, a further discount of 3d. per 1000 cubic feet be allowed for prompt payment.

Lighting of Kingskerswell.—The Kingskerswell lighting scheme was inaugurated last Tuesday, when the gas (supplied by the Torquay Corporation) was turned on by the Chairman of the Parish Council (Mr. H. Mortimer), and the first lamp lighted by the Mayor of Torquay (Mr. C. T. Towell). Alderman W. Adams, the Chairman of the Gas Committee of the Torquay Corporation, said there had been differences of opinion regarding a supply of gas to Kingskerswell, and, after much consideration, the Torquay Council had decided to provide the place with a better light. The price would be 1s. per 1000 cubic feet above that charged at St. Mary Church; but he hoped there would be a reduction at some future time. Regarding the price, he considered the Town Council had acted very fairly. He found that Ashburton paid 5s., Chagford 5s. 9d., Chudleigh 5s. 6d., and Moreton 5s. 6d.; whereas Kingskerswell was being charged only 4s. About a hundred inhabitants are having gas installed in their houses.

Efforts are being made to induce people engaged in a number of important industries, including engineering and enamelling, to go to Burton-on-Trent. Reference to the fact was made at the annual dinner of the local Chamber of Trade, when Mr. J. H. King, alluding to the proposed stove and fittings show-room for the Gas and Electricity Committee, said it was anticipated that at least £100 per week more would be realized when the new premises, of which particulars have been given in the "JOURNAL," were completed.

The Hereford Gas Committee at their last meeting recommended, with the approval of the Lighting Committee, that 100 lamps in the Whitecross district be fitted with Alder and Mackay's automatic controllers.

At the last meeting of the Leek Urban District Council, it was decided to take a shop in the Market Place for the display of the latest improvements in gas appliances, and relinquish the tenancy of the present show-room, which is in a less favourable position for the purpose required.

The Bristol Gas Company advertise a sale by auction, at Bristol, on the 11th prox., of £15,000 of general capital stock (with a maximum dividend of 5 per cent.) and £5000 of new debenture stock (bearing interest at the rate of 4 per cent.) The reserved prices will be advertised later. The Auctioneers are Messrs. George Nichols, Young, Hunt, and Company.

At the London Bankruptcy Court last Thursday, before Mr. J. B. Knight, Official Receiver, the first statutory meeting of creditors was held under the failure of Albert Oswald Ruscoe, gas engineer, carrying on business in High Street, Bletchley. The statement of affairs submitted was incomplete, but it showed unsecured liabilities amounting to £440, and a sum of £396 due to creditors whom the debtor treated as being partly secured. Debtor said some of his liabilities were in respect of guaranteeing royalties for the sale of an automatic controller for street-lamps, for which he had a licence for the sole manufacture and sale; but he unwisely guaranteed royalties to the extent of £300, and had obtained about £100 worth of business through this source. He was Managing Director of Ruscoes, Limited; but a Receiver was appointed for the debenture-holders in December last, and since then he had been employed at a salary. At the close of the meeting, the estate was left in the hands of the Official Receiver for summary administration.

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange has had a rather uninteresting week, and business was of the quietest. The old troublesome questions—Mexico and Labour—continued to drag on, with no sign of settlement perceptible; but at any rate they did not develop any new awkward features. Some little investment purchasing helped to sustain prices; so that, on the whole, quotations at the close did not come out very badly. The important Railway Market even showed some good advances. Consols also were firmer. The opening day, however, betrayed considerable uneasiness; the Mexican cauldron seething and bubbling again. Prices prudently retired, especially in Transatlantics. But no rush to sell eventuating, there was some recovery later. Rails took their own line and were firm; but Consols were ⅛ lower for the account, and American and Foreign were easier. Things moved unevenly on Tuesday; some being rather more active and stronger, others the reverse. On the whole, there was not much harm done. Rails were in good demand, and prices rose; but Government issues were not over strong. On Wednesday, markets were very quiet with a weaker tone; no beneficent factor being in operation. Consols were unchanged. Rails, however, showed some weak lines; and other leading markets drooped for lack of support. The course of things on Thursday was similar—a general tone of languor and inaction in which prices received no encouragement. Friday was as quiet as ever; some markets being quite stagnant. But Government issues found buyers, and Consols advanced ⅛. Rails and Transatlantics were lower, but not much; and Foreign showed a mixture of gains and losses. Saturday was about the same as usual, except that Rails were in very good form, and prices amended accordingly. Consols were steady, closing at 72⅝ to 72⅞—a rise of ⅛ in the week. The Money Market was stronger. Rates all round were firm, but not so hard as to cause apprehension. Business in the Gas Market was on a very fair scale in the aggregate, and was more evenly distributed throughout the list of undertakings. The general tendency was firm; and though only a few quotations actually advanced, yet there was no weak spot. In Gaslight and Coke issues, the ordinary was in good demand at firm figures, advancing from 102 to 103⅜—a rise of ⅜. In the secured issues, the maximum realized from 75¼ to 76, the preference from 93½ to 94½, and the debenture 74. South Metropolitan were unchanged at 108 to 109¼; and the debenture marked 73½. In Commercials, the 4 per cent. changed hands at 106⅜ and 107, and the debenture at 72¼. Among the Suburban and Provincial group, Alliance and Dublin was done at 55, Bournemouth "B" at 15, Brighton ordinary at 150½ and 150⅝, British at 45¼, Lea Bridge at 119, South Suburban at 116 and 116½, Tottenham "B" at 115⅜, Wandsworth "B" at 130½ and 131½, and (on the local Exchange) Newcastle at 99½. In the Continental companies, Imperial was done at 163 to 165, Union at 80 and 80⅜, ditto preference at 124½ to 125⅜, European at 17⅜, and Malta at 4½ and 4⅝. Among the undertakings of the remoter world, Bombay realized 6⅛ to 6¼, Oriental 125 and 125½, Primitiva 5⅞ to 6, and ditto preference 4⅞ to 5.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 15	4	Alliance & Dublin Ord.	53–58	..	6 17 11
374,000	,,	July 11	4	Do. 4 p.c. Deb.	80–83	..	4 16 5
280,000	5	Oct. 15	7½	Bombay, Ltd.	6–6¼	+⅛	5 15 5
50,000	10	Aug. 28	15	Bourne- mouth Gas & Water 10 p.c. B 7 p.c. Pref. 6 p.c.	28½–29½	..	5 2 2
347,500	10		7		14½–15½	..	4 11 10
75,000	10	,,	6		13½–13⅝	..	4 7 3
880,000	Stk.	Aug. 14	14	Brentford Consolidated	262–267	..	5 4 10
880,000	,,	,,	11	Do. New	203–203	..	5 5 9
50,000	,,	,,	5	Do. 5 p.c. Pref.	111–113	..	4 8 6
206,250	,,	June 13	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
217,380	Stk.	Aug. 28	11	Brighton & Hove Orig.	201–206	..	5 6 10
244,200	,,	,,	8	Do. A Ord. Stk.	149–152	..	5 5 3
530,000	20	Sept. 26	12½	British	44½–45½	..	5 9 11
120,000	Stk.	June 27	4	Do. 4 p.c. Deb. Stk.	87–89	..	4 9 11
245,771	Stk.		4	Buenos Ayres 4 p.c. Deb.	89½–91½	..	4 7 5
100,000	10	,,	—	Cape Town & Dis., Ltd.	2–3	..	—
160,000	10	—	—	Do. 4½ p.c. Pref.	3–5	..	—
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	75–80	..	5 12 6
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	103–111	..	4 10 1
1,513,380	Stk.	Aug. 28	5/9/4	Commercial 4 p.c. Stk.	105–107	..	5 2 1
560,000	,,	,,	5½	Do. 3½ p.c. do.	102–104	..	5 2 6
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	71½–73½	..	4 1 8
800,000	Stk.	,,	4½	Continental Union, Ltd.	79–82	..	5 9 9
200,000	,,	,,	7	Do. 7 p.c. Pref.	124–126	..	5 11 1
492,270	Stk.	—	4	Derby Con. Stk.	123–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11
1,002,180	10	July 30	10	European, Ltd.	17½–18½	..	5 8 1
16,386,660	Stk.	Aug. 14	4/17/4	Gas-light and Coke 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb.	102–104	+½	4 13 8
2,600,000	,,	,,	3½		74–77	..	4 10 11
4,062,235	,,	,,	4		93–96	..	4 3 4
4,674,850	,,	June 13	3		73–74	..	4 1 1
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	83–90	..	5 11 1
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	163–172½	..	6 7 6
131,000	Stk.	Sept. 11	7⅞	Ilford A and C	150–153	..	4 19 8
65,780	,,	,,	6½	Do. B	118–120	..	5 2 1
65,500	,,	June 27	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,000	Stk.	Nov. 13	9	Imperial Continental	160–165*	..	5 9 1
1,235,000	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	83½–85½	..	4 1 10
200,242	Stk.	Aug. 28	6½	Lea Bridge Ord. 5 p.c.	118–121	..	5 3 4
561,000	Stk.	,,	10	Liverpool United A	206–208	..	4 16 2
718,100	,,	,,	7	Do. B	145–147	..	4 15 3
806,083	,,	June 27	4	Do. Deb. Stk.	95–97	+1	4 2 6
63,140	Stk.	June 27	3	Maidstone 3 p.c. Deb.	66½–68½	..	4 7 7
75,000	5	June 13	6	Malta & Mediterranean	4½–5	..	6 0 0
250,000	100	Oct. 1	4½	Met. of Melbourne 4½ p.c. Deb.	96–98	..	4 11 10
541,920	20	May 30	4	Monte Video, Ltd.	12–12½	..	6 8 0
1,775,892	Stk.	July 30	4½	Newc'tle&G'tesh'd Con.	£9–100	–¼	4 10 0
529,705	Stk.	June 27	3½	Do. 3½ p.c. Deb.	83½–84½	..	4 2 10
55,940	10	Aug. 28	7/10,6	North Middlesex 7 p.c.	12½–13½	..	5 11 5
800,000	Stk.	May 16	8	Oriental, Ltd.	124–129	..	6 4 0
60,000	5	Sept. 26	10	Ottoman, Ltd.	8–8½	..	5 17 8
60,000	50	Aug. 14	13	Portsea, Island B	127–130	..	5 0 0
100,000	50	,,	12	Do. C	120–123	..	4 17 7
249,980	5	Oct. 15	8	Primitiva Ord.	5⅜–6¼	..	6 8 0
499,960	5	June 27	5	,, 5 p.c. Pref.	4¼–5¼	..	4 17 7
521,600	100	June 2	4	,, 4 p.c. Deb.	93–95	..	4 4 3
346,198	Stk.	June 27	4	River Plate 4 p.c. Deb.	83–90	..	4 8 11
275,000	5	Sept. 26	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11–11½	..	5 4 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
185,000	Stk.	Aug. 28	10	Sheffield A	222–224	..	4 9 8
209,984	,,	,,	10	Do. B	221–223	..	4 9 8
523,500	,,	,,	10	Do. C	220–222	..	4 10 1
90,000	10	Oct. 15	7½	South African	9½–10½	..	7 2 10
6,429,895	Stk.	Aug. 14	5/9/4	South Met., 4 p.c. Ord.	108–110	..	4 19 4
1,895,445	,,	July 11	3	Do. 3 p.c. Deb.	72–74	..	4 1 1
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	157–159	..	5 6 11
952,795	Stk.	,,	6	S'th Suburb'n Ord. 5 p.c.	115–117	..	5 2 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
117,058	,,	June 27	5	Do. 5 p.c. Deb. Stk.	115–117	..	4 5 6
594,740	Stk.	Nov. 13	5	Southampton Ord.	100–103*	..	4 17 1
120,000	Stk.	Aug. 14	7⅜	Tottenham A 5 p.c. and B 3½ p.c.	136–139	..	5 6 1
543,940	,,	,,	6⅝		114–116	..	5 1 3
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	90–92	..	4 7 0
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	111–113	..	4 8 6
				Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Aug. 28	8⅜	Wandsworth A 5 p.c.	155–160	..	5 4 8
255,636	,,	,,	6⅝	,, B 3½ p.c.	130–135	..	5 1 10
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110–115	..	5 2 0
352,000	,,	,,	6½	Wimbledon 5 p.c.	111–116	..	5 5 7
98,000	,,	,,	6⅝	Epsom 5 p.c.	115–120	..	5 10 5
88,416	,,	June 27	3	3 p.c. Deb. Stk.	68–70	..	4 5 9

Prices marked * are "Ex-Div."